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MACHINERY

A JOURNAL OF METAL-WORKING PRACTICE AND MACHINE TOOLS

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Abstracts of Principal Articles

The New Vauxhall Press Shop.....P. 1432

The expansion scheme announced by Vauxhall Motors, Ltd., in 1954 has now been completed. Probably the most important part of this scheme was the provision of a new body-building shop, with a floor area of 1¼ million sq. ft., which includes a press shop of the most modern construction. At one side of this shop there is a steel store where packaged and coil material is prepared for feeding to the presses. The latter are arranged in lines, facing towards the steel store so that the pressings can progress through them towards the body-assembly building. All the larger presses, most of which are of the under-driven type, are mounted on a network of girders above an extensive basement, so that routine maintenance and inspection can be carried out without stopping production. In the basement, there are scrap conveyors on which more than 300 of the 1,000 tons of material consumed per week is carried to a centralized baling house. Certain of the lines are laid out for the production of specific components, inner and outer panels for doors, for instance, being made on two adjacent lines. At the end of one line, the two panels are brought together and assembled by spot-welding in special welding presses. Several lines of smaller presses are also included in the non-basement area of the shop. Attention is drawn to the use of conveyors for the movement of panels between the presses on which successive operations are performed, arrangements for the loading and unloading of tools and their transport, and the feeding of sheet material by automatic units developed by the company. (MACHINERY, 92—20/6/58.)

INA Needle-type Self-aligning and Thrust Bearings .....P. 1457

Some recent additions to the INA range of needle-type bearings are described in this article, including a self-aligning bearing with an outer race of radiused form, and a precision-drawn steel housing incorporating two support rings which form the seating. In addition, thrust races equipped with 2-mm. diameter needles are available in a range of sizes and may be employed with or without plain, hardened washers. A series of needle-bearing cam followers has also been introduced. (MACHINERY, 92—20/6/58.)

Gauges for Checking Workpieces with Conical Ends.....P. 1459

One of the gauges here described provides for measuring the length of the parallel portion of a cylindrical workpiece with a conical end. The gauge has two components, each with a V-groove, one component being used for locating the workpiece and the other as a seating for the cone end. The grooves have included angles of 90 and 120 deg., to provide for checking the position of a datum diameter on a cone end, relative to the plain end of a workpiece, and can be employed whether the datum diameter lies within the limits of the cone end or outside them. (MACHINERY, 92—20/6/58.)

The Production of Precision Studs for Severe Duties .....P. 1469

For conventional and nuclear power generating installations and similar applications, special studs of high strength and good finish may be required, sometimes in very large sizes. The Stud Division of the Standard Pressed Steel Co., U.S.A., is producing such studs up to 6 in. diameter and 72 in. long. Equipment installed for this purpose includes a tracer-controlled lathe of large capacity, a special machine for rolling threads up to 4 in. diameter, and a matrix thread grinder which has been modified to enable workpieces up to 65 in. long to be handled. Operations involved in the production of a batch of stainless steel studs of 5 in. diameter by 60 in. long are briefly described. (MACHINERY, 92—20/6/58.)

Distortion Reduced by Automatic Marquenching .....P. 1472

A mass marquenching technique has been introduced at the Fort Wayne, Ind., works of the International Harvester Co., U.S.A., for the heat-treatment of gears, pinions and shafts. It is claimed that by the use of this process, distortion of these parts is kept to the minimum, since with marquenching the core is hardened first, thereby allowing it to expand and contract without any restriction due to a hardened case. Furthermore, it is stated that the service life of components treated in this manner has been increased by as much as 200 per cent in some instances. Automatically-operated batch-loaded furnaces, and a special quenching oil, are employed, and each furnace has a 4-zone temperature control. Special cast-alloy fixtures are used to hold the parts during the heating and quenching, and after the treatment, the components are shot-blasted on a rotary table machine, and then inspected and tested. (MACHINERY, 92—20/6/58.)

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

IN FORTHCOMING ISSUES

The production of calculating and ticket-issuing machines—Employment of the blind in industry.

The Possibilities of Composite Plastics-metal Sheet

For many metal components, particularly where appearance is important, finishing processes, either for decorative purposes or for protection against service conditions, may represent a substantial proportion of the total cost of the manufacture. Frequently, such parts are made from sheet metal by press operations, and it has long been appreciated that considerable economies could often be effected if the final finish could be imparted to the surface while in this form, rather than to the individual items. Various forms of prefinished sheet material have, of course, been available in the past, but applications have been restricted by reason of the somewhat severe treatment which must often be withstood without damage during the subsequent processing stages. More recently, plastics, which have been the subject of such rapid development in many directions, have been successfully applied for pre-coating metal sheet, and it is claimed that as a result the potential field for such material has been considerably extended.

In particular, it is reported, vinyl-metal laminated sheet is already being used with advantage for a diversity of purposes, and, as yet, its possibilities have by no means been exhausted. One attraction of this material is the variety of finishes that can be provided, since the vinyl sheet, which may range in thickness from about 0·004 to 0·020 in., is obtainable, for example, embossed and printed to simulate wood, leather, or marble; in cloth and basket-weave textures; and in metallized forms. A company in the U.S.A., which is among the leading users of laminated material of this nature is applying such sheet to steel, aluminium, and magnesium, of thicknesses from 0·015 to 0·060 in. Labour cost for bonding vinyl to flat metal sheet is said to be substantially less than for painting or plating individual stamped or drawn parts, and the need for such equipment as spray booths and guns, ovens, and conveyors, is avoided. Moreover, inspection for finishing defects can be eliminated, and it may be possible to employ backing material of a lighter gauge than would be necessary when working with all-metal sheet.

To ensure a bond of the necessary strength, the surface of the metal is roughened by a phosphatizing treatment before it is roller-coated with a thermoplastic adhesive. Subsequently, the coated sheet is preheated to evaporate solvent and then heated in preparation for bonding. For the latter purpose, the hot metal and the vinyl sheets are brought together and pass between rubber rolls which serve to press them into intimate contact.

With correct bonding, the laminated material can subsequently be processed by methods which are generally similar to those applicable to uncoated metal sheet, although certain modifications to tooling may be desirable. In particular, it is stated, vinyl must not be "crowded" but allowed to flow freely. High holding pressures have been found necessary, and draw beads are used more extensively than in normal dies. Lubrication of dies is important and tallow has been found very satisfactory for the purpose, although compounds with a vegetable-oil base, which are less expensive, have also been used with success. As compared with those suitable for steel sheet, drawing speeds must be low.

A restriction has hitherto been imposed on the use of metal-plastics laminate material by reason of the fact that it has not been feasible to carry out welding operations without spoiling the vinyl layer. It is understood, however, that it has now proved possible to overcome this drawback, in certain instances, as a result of the development of a special projection-welding technique, whereby clips, brackets, and hinges, for example, can be secured to the steel backing surface. The projections serve to concentrate the heating effects, and magnetic force, instead of hydraulic or pneumatic pressure, is employed to hold the components in contact. With this system, it is stated, the necessary conditions for successful welding can be ensured by accurately synchronizing the heating and pressure to a fraction of a cycle. Because the vinyl facing layer is an insulator, the current flows only through the metal backing and the component to be attached. An example of the application of this process is afforded by the welding of steel clips to the metal portion of a laminate pressing for a portable wireless set.

It will be evident that pre-coated sheet of the type here discussed represents an important addition to the range of materials at the disposal of the designer, and one that should be welcomed by the production engineer. Already it has been adopted, for instance, for various interior trim parts for motor cars, and it is suggested that it may be employed in the future for roof panels and wings. Other existing applications are concerned with furniture tops, appliance and camera cases, business machine housings, doors, and seat backs.

The New Vauxhall Press Shop

The important expansion scheme announced in September, 1954, by Vauxhall Motors, Ltd., Luton, to increase the productive capacity from 130,000 to more than 250,000 cars, vans and trucks per year, at a cost of £36 million, has now been virtually completed. Originally the programme was due for completion in 1959, but the plans were later modified to ensure that the work would be finished this year. In addition to providing for a very substantial increase in the total number of vehicles made by the company, arrangements were made to increase the percentage of Vauxhall-manufactured components, and to bring all the production facilities up to a high standard of efficiency. That this last-mentioned requirement has been fulfilled will be evident from the up-to-date methods employed for the production of gearboxes (MACHINERY, 92/760—4/4/58 and 92/944—25/4/58) and stub axles (MACHINERY, 92/1316—6/6/58) which are typical.

Such modern equipment for the production of mechanical components and assemblies for Vauxhall Victor, Velox, and Cresta cars, which will form the subject of several further articles to be published later, has been supplemented by the provision of a large and very modern press shop for the manufacture of sheet metal body components. In addition to the new press shop, greatly increased facilities have been provided for tool and die making in a building which is conveniently situated, so that the heavy tools have only to be transported for a short distance to the press shop. The assembly of car bodies from the panels produced, attachment of the mechanical units, trimming of the completed bodies, and paint finishing, are all performed in a single building, of which the press shop forms part. This building is situated close to the main machine and assembly shop for such mechanical units as engines, gearboxes, and front and rear suspensions, which are transferred to the final assembly stage by means of conveyors.

NEW FINAL ASSEMBLY BUILDING

Some particulars of the main machine shop for the production of the mechanical units for the cars were given in the first of the articles mentioned above, and the new press shop and some of its associated facilities are here described. As a result of the expansion scheme, the floor area available for manufacturing operations at Luton has been increased from 3½ to 5 million sq. ft., and is now devoted almost entirely to the production of cars and light vans, which have many components in common. Commercial vehicle manufacture, and the distribution of spare parts, has been transferred to another new factory, covering more than 1½ million sq. ft., at Dunstable. A general view of the new building at Luton, which has an area of 1½ million sq. ft., on four levels, is given in the heading illustration, where the end of the main machine shop can just be seen at the extreme left-hand side.

This body production building is approximately L-shaped in plan, and has overall dimensions of 1,450 ft. and 882 ft. The press shop, which forms the "foot" of the L, is nearly 400 ft. wide. From

this shop, the body panels and components progress into the "leg" portion of the building, at the level of the press shop floor, where they are assembled into complete bodies. Bodies are transferred from the ground floor to the paint shop on the floor above, whence they pass further upwards into a penthouse containing drying ovens, as necessary, and then to the trimming shop, on the same floor. After trimming, and the fitting of various minor sub-assemblies such as steering columns, which are assembled in the trim shop for convenience, the bodies are returned to the ground floor for final assembly. Here, the mechanical units are fitted and adjusted, and the cars emerge from the left-hand end of the building, in the heading illustration, ready to be driven away. In addition to the three floors mentioned, this building has a basement, which is employed, among other purposes, for the manufacture of seat frames, and the attachment of the springs and upholstery, many interesting techniques being employed in this section.

Incorporating all the most advanced features of construction, the new press shop is of 2-storey design with a basement extending for most of its length. On one long side of the shop, on the right in the heading illustration, there is an area devoted solely to the storage of steel sheet and coil, and cutting it into blanks of suitable sizes for feeding to the presses. A general view inside the steel store, from near one end, is given in Fig. 1, and the area is approximately 100 ft. wide. The columns at each side of the store area support run-ways for three Carruthers cranes, each of 25 tons capacity, which are employed solely for the movement of material in this area. Sheet material, in the form of coiled strip up to 6 ft. wide, and packaged rectangular or square sheets, arrives at the works on lorries, which can be driven into the store area through doors in the wall at the right in Fig. 1, so that they may easily be unloaded by means of the cranes.

There are four such entrance doors, and at each there is a large, brick-built porch on the outside of the building, with further doors, as seen in the heading illustration. Thus, a lorry which is entering or leaving can wait in the porch while one set of doors is closed and the other set opened, and the cold draughts which would otherwise accompany the arrival or departure of vehicles in the winter months are avoided.

More than 1,000 tons of sheet material pass through the store area every week, and ample provision has been made for cutting it into suitable sizes and shapes for the different panels to be produced. The arrangement of this shearing and blanking equipment is indicated on the plan drawing of the press shop and material stores in Fig. 2, and there are two de-coiling lines supplied by the McKay Machine Co., U.S.A. (Rockwell Machine Tool Co., Ltd.), which handle all the material supplied in the form of coiled strip.

McKAY DE-COILING LINES

One of these de-coiling lines is seen in the foreground in Fig. 1, and a close-up view, looking towards the press shop, is given in Fig. 3. Here, the next coil to be used is seen standing at the right on the V-surfaces which form the top of a moving carriage. This carriage is supported on flat guide surfaces on the bed of the coil-holding

Fig. 1. In this General View of the Steel Stores Area of the New Press Shop at the Works of Vauxhall Motors, Ltd., Luton, One of the Two McKay De-coiling Lines is seen in the Foreground

unit, which is T-shaped in plan. On each side of the portion of the bed whereon the carriage is supported, there are further guides, which carry movable housings for large cone-centres, whereby the coil in use is held at a convenient height. When the coil has been used up, the centre housings are moved apart hydraulically, by means of push-buttons and control levers, and the coil carrier is brought to a position between the housings. The top of the moving carriage is then raised to bring the new coil into alignment with the cone centres, and the latter are moved inwards to grip it. When the carriage has been lowered and retracted, in readiness for re-loading, the new strip can be threaded through the de-coiling unit which serves to pull the strip from the coil and feed it into a storage loop.

Another view, showing the de-coiling unit at the right, and the 20-ft. deep, concrete-lined pit in the floor, which accommodates the storage loop, is given in Fig. 4. Before being lowered into the pit, the end of the newly threaded coil is engaged with the entry rolls of the feed unit at the left, and for this purpose, the end of the strip is supported above the pit by means of a hinged, gate-like framework, attached to the side of the decoiling unit. This gate is raised to a horizontal position by means of a hydraulic cylinder, seen at *A* in Fig. 4, the ram of which is connected to a lever on the end of the hinge pin. After the coil end has been threaded through the rolls of the feed unit, the gate is lowered and the de-coiler is operated under hand control to lower the strip into the pit so that it forms a loop, as shown. On one wall of the pit there are four photo-electric cells, arranged vertically at approximately equal spacings, and on the other side, four lamps fitted with lenses which direct light beams on to the cells. When the loop from the coil is almost at the bottom of the pit, all the light beams are obstructed, and the 15-h.p. variable speed D.C. driving motor for the de-coiling unit is stopped, so that the strip feed is interrupted.

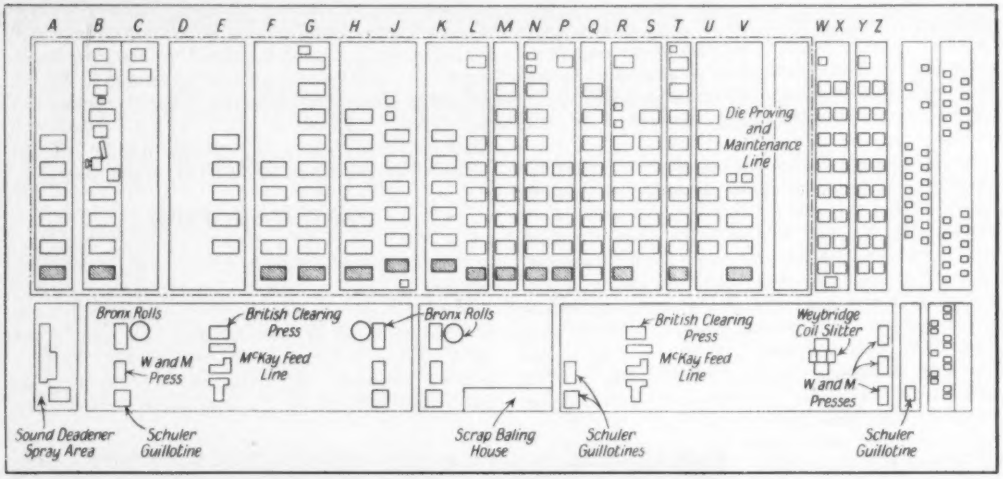

A B C D E F G H J K L M N P Q R S T U V W X Y Z
Die Proving and Maintenance Line
Bronx Rolls
British Clearing Press
W and M Press
McKay Feed Line
Bronx Rolls
British Clearing Press
McKay Feed Line
Weybridge Coil Slitter
W and M Presses
Sound Deadener Spray Area
Schuler Guillotine
Scrap Baling House
Schuler Guillotines
Schuler Guillotine

Fig. 2. Plan Drawing of the New Vauxhall Press Shop Showing the Disposition of the Presses in Lines Facing Towards the Steel Store Area. In the Majority of the Lines the First Machine is a Drawing Press of the Double-acting Type

As the material is taken up by the feed unit, and the length of the loop is reduced, the speed of the de-coiler drive motor is varied by the uncovering of the two middle photo-cells, which serve to control output rate from the de-coiler so as to maintain a loop of sufficient length to prevent any drag on the rolls of the feed unit. Should the feed unit take up the strip so fast that the uppermost of the four photo-cells is uncovered, the current supply to the feed unit driving motor is automatically interrupted. The feed unit, at the left in Fig. 4, is electrically controlled and is also driven by a variable speed D.C. motor. Provision is made for feeding the strip rapidly until the end is within a few inches of the cutting position, when the rate

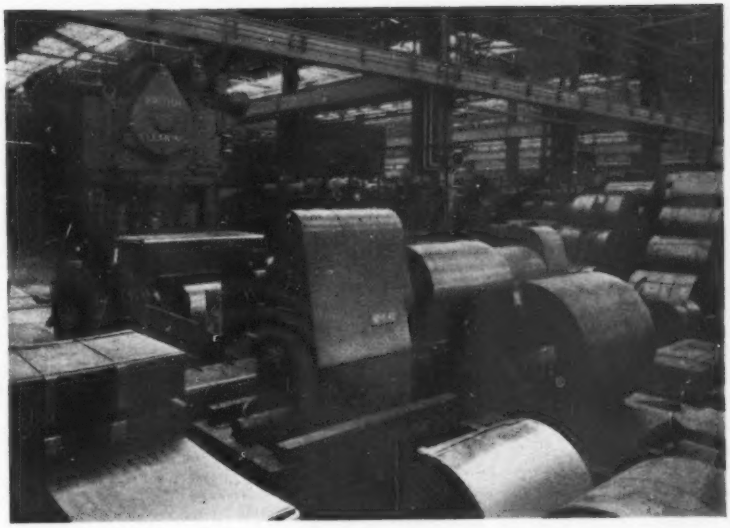


Fig. 3. Some of the Equipment of One of the Two McKay De-coiling Lines for Producing Blanks from Coiled Stock. Movements of the Cone Housings of the Coil-holder Unit are Effected Hydraulically

is reduced automatically, and the strip is advanced slowly for the remaining distance. In addition, the operation of the feed unit is synchronized with that of the blanking press, which can thus be run continuously according to the maximum speed at which the material can be fed, and the size of the blank that is being produced.

The feed unit incorporates a backed-up roller levelling unit which ensures that the strip is flat when it reaches the press. At the left-hand end of the line, there is a British Clearing (Rockwell Machine Tool Co., Ltd.), 4-point suspension, single-acting press, of 300 tons capacity, with a bed opening 84 in. wide, which accommodates the widest strip in use. This press may be fitted with a variety of tools, depending upon whether the material is to be cut into shaped blanks or merely sheared into rectangles or squares. A general view, from the front of the press, showing a set-up for producing shaped blanks, from which door pillars will be formed, is given in Fig. 5. For this blank, a cut-off die is employed, kickers being fitted to eject the blanks when the slide is at the top of its stroke.

As the blank falls from the die, it lands on the inclined surfaces of a steel tube and angle-section framework, which is supported on brackets at each side of the die opening. Levers and connecting

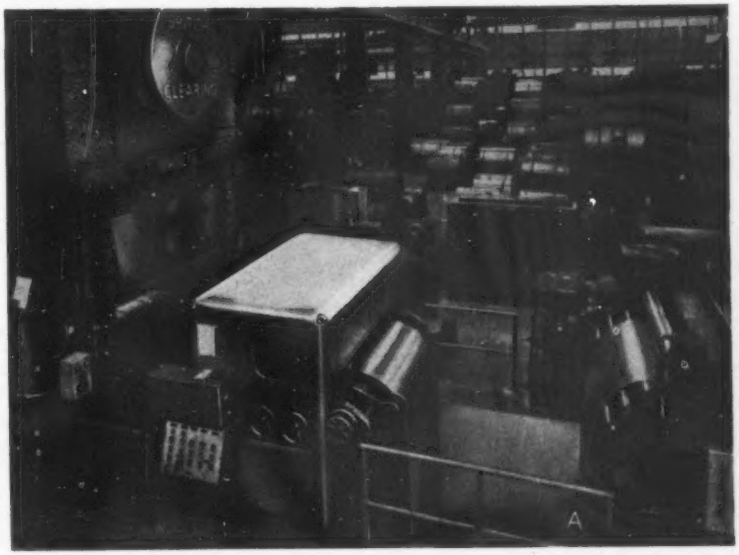


Fig. 4. Between the Feed Unit and the Roller Leveller there is a 20-ft. Deep Pit Containing Four Photo-electric Cells, whereby the Rate at which the Material is Fed is Varied in Accordance with Demand

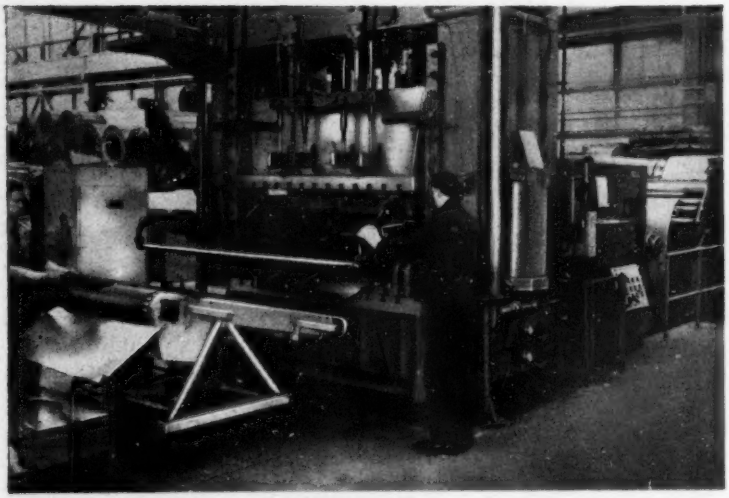


Fig. 5. View, from the Front, of the British Clearing 300-ton Press Employed in Conjunction with the De-coiling Line for the Production of Shaped or Rectangular Blanks from Coil Stock

links, attached to the framework, are connected to the die in such a manner that, as the slide ascends, the framework is carried forward to a position where it is located directly beneath the blank.

From the framework, the blank slides down on to the end of an inclined, moving-band type conveyor, located in front of the press. The conveyor is representative of a number employed in the shop for the movement of panels between presses, and this particular unit was supplied by V.M.F. Handling Equipment, Eastern Industrial Estate, Harlow, Essex. It has pulleys spaced 5 ft. apart and a band width of 3 ft., and can be adjusted, by means of a hand-operated hydraulic pump connected to a cylinder at the end remote from the pivot point, to any convenient angle. The supporting framework for the conveyor is mounted on castors so that it may be moved easily into position.

Blanks leaving the conveyor are placed on a pallet for transfer to the next operation. For the comparatively narrow blank shown, which is about 9 in. wide, the press is set to run continuously at the rate of 15 strokes per min. Wider blanks necessitate a slower speed, to enable the strip to be fed through the required distance. From the blanking press, the material is transported on a Coventry Climax or Lansing Bagnall fork-lift or pallet truck, either to the main press shop, or, alternatively, to one of three sets of manipulating or flexing rolls provided in the stores area. A general view of one of these sets of rolls, which were supplied by the Bronx Engineering Co., Ltd., is given in Fig. 6. At the feed side of each set of rolls, there is a turntable with a 12-ft. diameter surface covered with steel chequer plates, on which there is room for three material support benches, of sufficient size to accommodate the largest blanks employed.

With this installation, fresh material can be deposited on one of the support benches without interrupting the feeding of material from the bench nearest to the rolls. When this material has been consumed, it is only necessary to rotate the turntable to bring a fresh batch of material into position for processing. At the farther side of the rolls, the processed material is loaded, by another operator, into a neat stack on a platform pallet, supported on a wheeled chassis for ease in manœuvre, and the pallet is then picked up by a fork-lift truck for delivery to the drawing press. The Bronx flexing rolls are employed to equalize the internal stresses which normally are set up during ageing of the steel sheet after the final rolling operation at the steel mill. Failure to equalize these stresses may result in the appearance of surface defects on those areas of a blank which were not stretched sufficiently in the drawing operation.

Although sheet material can be subjected to a temper-rolling operation at the steel mill, to remove these unequal internal stresses, this treatment is effective for only two to three weeks, after which ageing again introduces stresses. It would be difficult to ensure that temper-rolled material was consumed within this period, so that the alternative, of manipulating the material to produce a plastic condition, is preferred. Manipulation or flex-rolling is performed a few hours before the material is to be drawn, so that there is not sufficient time for ageing to set in. On the Bronx machine, the material is fed initially through a pair of rotating brush rolls which extend for the full

6-ft. width, and serve to remove any foreign matter from both sides.

After passing these brushes, the strip enters, in succession, two sets of pinch rolls which are separated by a distance of about 6 in. Between these sets of rolls is the flexing roll, of approximately 3 in. diameter, the bearings for which are held in vertically-sliding blocks at each end. These blocks are guided in vertical ways machined in the end castings of the machine, and can be raised into contact with adjustable stops by hydraulic cylinders.

The second assembly of pinch rolls comprises two pairs of rolls, of which the lower are at a fixed level. The upper rolls of this set are thrust downwards by strong springs to grip the sheet, and when the leading end of the material enters, the upper rolls are raised, operating a micro-switch. This micro-switch energises a solenoid-operated pilot valve, with the result that oil pressure is admitted to the two cylinders which raise the flexing roll to the required height.

As a result, the sheet is caused to make two sharp bends in quick succession, as it passes up over the flexing roll and down into the second set of pinch rolls. A crank and connecting rod arrangement ensures that the vertical movement of the flexing roll is the same at both ends, so that the roll is always parallel to the pinch rolls even if stock is fed in at the extreme end. A maximum vertical travel of 5 in. can be imparted to the flexing roll in a time of only 0·4 sec., so that only a short portion of the sheet, at the leading edge, remains unprocessed. An extra micro-switch is fitted to the machine which is operated if two or more thicknesses of material are fed together. Should this happen, the main driving motor is switched off automatically.

After it has passed the flexing roll, the sheet emerges into the levelling unit of the machine, on the right in Fig. 6, and is fed between six upper and five lower rolls, each of 4½ in. diameter. These rolls are all supported near their centres by staggered back-up rolls, and the housings for the upper rolls can be set down, if required, so that the sheet can be flexed at the ingoing side, the remaining rolls then serving to flatten the material as it is passed through.

Power for the machine is supplied by a 45-h.p. D.C. motor, which provides three speeds for forward, and one for reverse, running, the speeds being selected by push buttons. The operating speeds are about 40, 80, and 120 ft. per min., and the reverse speed 40 ft. per min. It is preferable to feed the sheet so that the direction of the grain is in line with the direction of movement, but with narrow panels, such as those being blanked in Fig. 5, which are cut across the strip, this is not possible.

Alongside each set of Bronx rolls is a Wilkins & Mitchell single-acting press, of 200 tons capacity, with a bed width of 96 in., as seen in the background in Fig. 6, and there is also a 96-in. wide Schuler (Pearson Panke, Ltd.), guillotine. These machines are employed for the production of blanks of various sizes and shapes from sheet material.

A 48-in. wide Weybridge (George Cohen Sons & Co., Ltd.), gang slitting machine is used for cutting sheet into narrower widths, should this operation be necessary. At the far end of the steel

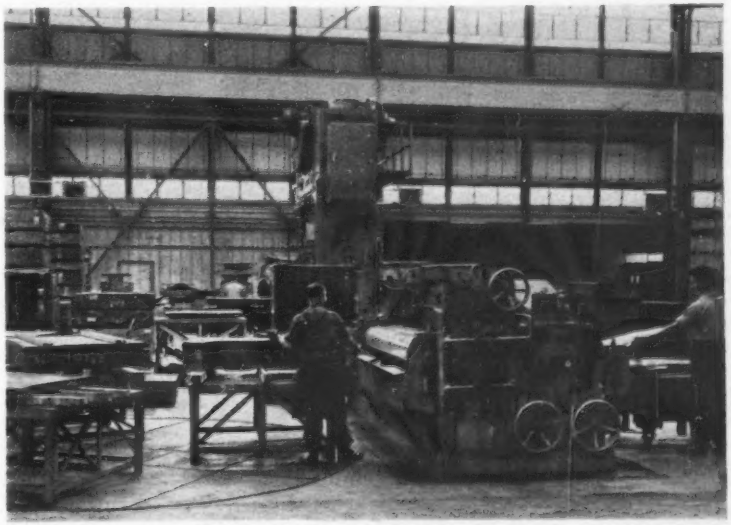


Fig. 6. Cold Flexing of the Sheet Material to Produce a Plastic Condition, in Readiness for the First Drawing Operation, is Performed on One of Three Sets of Bronx Manipulating and Roller - levelling Machines

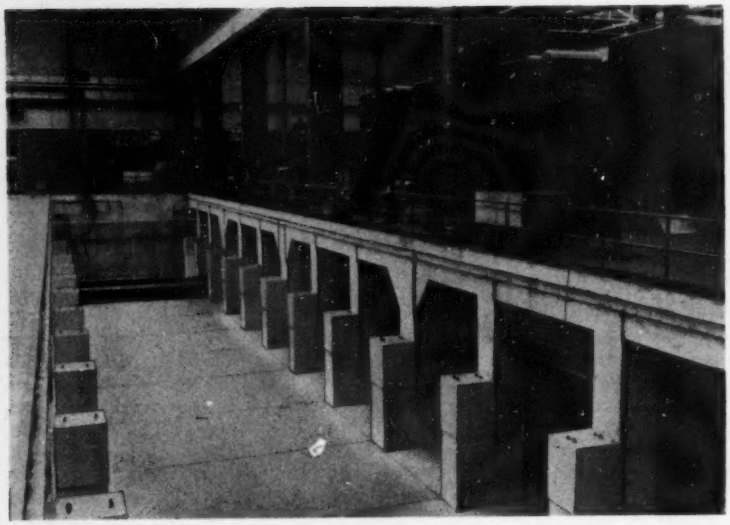


Fig. 7. View of one of the Empty Bays in the Vauxhall Press Shop Showing the Reinforced Concrete Piers on which the Girders Carrying the Presses are Supported

stores, as viewed in Fig. 1, there are 13 H.M.E. inclinable presses, employed mainly for the production of shaped and formed blanks, from salvaged material, for body components such as brackets, and further reference will be made to these machines later.

Situated nearby, there are three more Wilkins & Mitchell presses, two of 200 tons capacity and 72-in. bed width, and one of 250 tons and 96-in. bed width, which are employed for the production of the various shaped blanks required.

THE PRESS SHOP

In the new press shop, all the latest ideas have been adopted for the efficient production of body panels and for the disposal of the resultant scrap material, which is produced at the rate of more than 300 tons per week, approximately one third of the material which enters the stores being converted into scrap trimmings and returned to the steel manufacturers. The press lines on which the major car components are produced are mounted above a basement which extends for the width of the shop and for almost its entire length, as indicated by the chain-dotted outline in Fig. 2. The presses are installed in lines, all facing towards the steel stores area, so that the material can progress from the stores, through the successive drawing, trimming, piercing and forming operations towards the panel stores

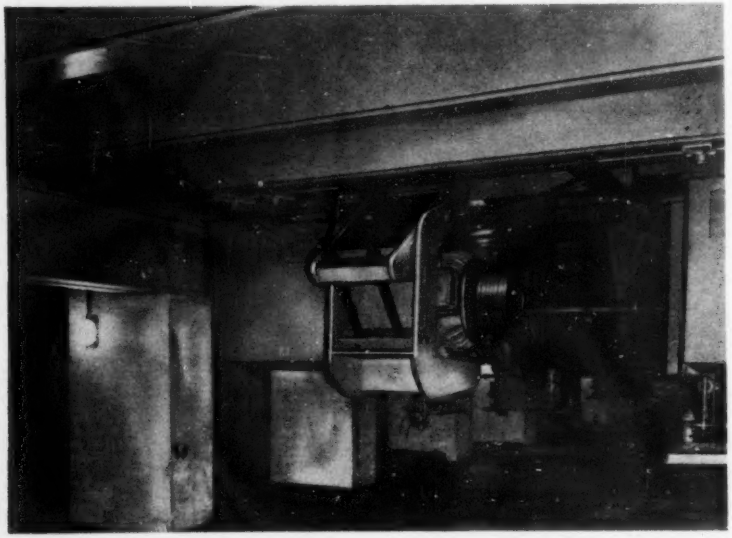


Fig. 8. Double Girders on the Concrete Piers in the Basement Support Cross Girders Carrying the Presses. With the Under-driven Arrangement, the Main Drive Mechanism of the Press is Easily Accessible for Maintenance

Fig. 9. Line *K*, Fig. 2, here seen on the Right, is Headed by one of the Two Largest Presses in the Shop, with Beds Measuring 144 by 84 in., and Capable of Applying Forces of 800 and 500 tons with the Main and Blank-holder Slides, Respectively

and body-building shop at the other side.

Two lines will provide for later expansion and, temporarily, these have been left empty. A view of one of these lines looking down on the basement floor from the press shop level is given in Fig. 7, from which it may be seen that the press shop floor is supported on reinforced concrete columns. This floor extends only between the lines of machines and is normally kept completely clear for transport purposes. Near the base of each support column, there is a concrete pier and when presses are to be installed, I-section girders, with webs 24 or 30 in. depth, are placed on these piers and secured to them. Similar girders are then assembled cross-wise, to support each press at a height such that the bed is level with, or just above, the press shop floor. In the spaces between the presses are placed other, smaller, girders, and on these flooring is laid, in the form of wood blocks.

This flooring is so laid that it may easily be taken up when access to the basement is required. A view in the basement, showing the drive for one of the largest presses installed in the shop, is given in Fig. 8, where the rows of support columns, their girders, and the cross-girders which directly support the presses, are clearly seen. The press in question is the first in line *K*, Fig. 2, and is a British Clearing machine of the double-acting, 4-point suspension type, which will exert forces of 800 and 500 tons on the punch and draw-ring slides, respectively, and has a bed measuring 144 by 84 in. Fig. 9 is a general view in the press shop, showing line *J*, Fig. 2, at the left and line *K* at the right, and the machine at the extreme right, at the head of line *K*, is the machine to which Fig. 8 relates.

All the larger presses on the basement area of the press shop are British Clearing machines, built by Vickers Armstrongs (Engineers), Ltd., at their Elswick and Scotswood works, and supplied by the Rockwell Machine Tool Co., Ltd. On this area there is provision for 20 lines of presses, the number in each line ranging up to 10, and a total of 114 large machines is installed in these lines. Of these, 88 are of the under-driven type, in which the driving mechanism is beneath the press and projects into the basement. The remainder of the presses are of the conventional top-driven design. In addition, there are three special spot-welding presses, to which specific reference will be made later. Each of the lines, with the exception of those marked *E*, *Q*, *S* and *U*, Fig. 2, is headed by a heavy double-acting, under-driven press of the type seen in the foreground in Fig. 9, which performs the initial drawing operation on the panel that is being produced on that particular line of presses.

Included among the 14 double-acting presses installed in the shop are two of the type shown at the right in Fig. 9, to which reference has already been made. These presses are at the heads of lines *K* and *V*, Fig. 2, the latter being employed for the purpose of tool proving, so that it must accept the largest tools employed in the shop. Line *K* provides for the production of such components as the roof and the under-body, which are the largest pressings made. A view of a completed under-body pressing, in its inspection fix-

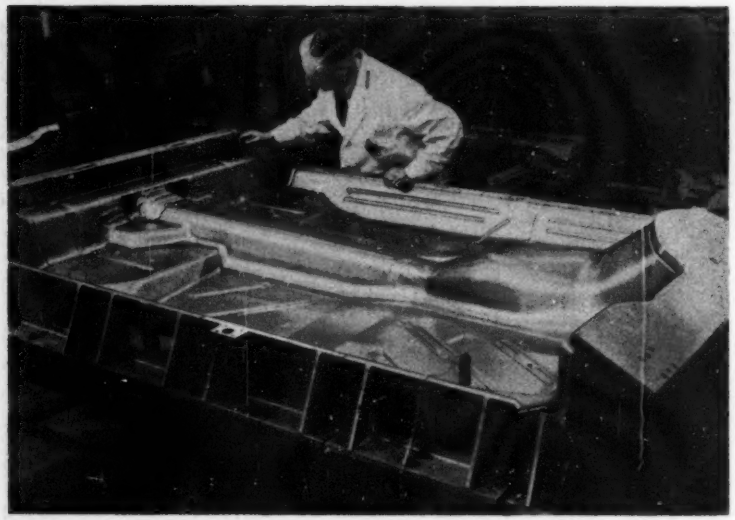


Fig. 10. The largest Pressing Made in the Shop is the Floor Pan for the Velox and Cresta Cars, here seen in its Inspection Fixture. The Initial Drawing Die for this Pressing Weighs about 40 tons

ture, is given in Fig. 10. Measuring approximately 7 ft. by 5 ft., it extends from the front bulkhead to the back of the rear seats of the car. In Fig. 9, line *K* is set up for the production of this panel, and an example is seen leaning against the side of the large press. When the photograph was taken, the sheets were being hand fed, but this practice will be superseded by the provision of automatic loading, as will be explained.

In addition to the two largest presses of the double-acting type, there are two with bed dimensions of 96 by 60 in., at the head of lines *A* and *B*, at the extreme left-hand side of the shop in the plan, Fig. 2. These two lines are laid out exclusively for the production of the eight different designs of doors, and the two different boot lids, which are required for the Vauxhall range of cars. It is intended, in a later article, to describe some of the more interesting series of operations in detail, so that only brief references will here be made, but it may be noted that the production of doors and boot lids on these two press lines is performed by the most efficient of current methods.

The leading press in line *J*, which is seen at the left in Fig. 9, has a bed measuring 108 by 72 in., and forces of 600 and 400 tons can be applied by the main and the draw-ring slides, respectively. This line is employed, in conjunction with a special Federal seam-welding machine, for the production of eight different front and rear wing pressings.

Other double-acting presses include units with beds ranging from 96 by 48 to 48 by 36 in., which are employed for the production of such components as instrument and dash panels, mouldings, door pillars, and bonnets. The leading presses are followed, in all the lines, by single-acting machines having comparable bed dimensions on which such operations as trimming, re-striking, piercing and forming are carried out. As mentioned earlier, the majority of the presses are of the under-driven type, and among the advantages associated with this arrangement, the most important is probably the fact that routine maintenance checks can be carried out in the basement, usually without stopping production. Switchgear for the presses is installed in the basement, alongside each machine, and current is supplied through 2,000-amp. main bus bars and 300-amp. distribution bars leading to each cabinet.

Since the press crown contains only slide counter-balance cylinders, a minimum of headroom is required above each press, and the movement of overhead cranes is facilitated. Such cranes can be employed exclusively for the movement of dies and materials, and are not required for maintenance work on presses. With the press mechanism beneath the press shop floor, noise is much reduced, with beneficial effects on the operator. A breakdown of a machine, with the in-line arrangement here employed, need not necessarily interfere with production, since panels can often be passed, on a conveyor, through the machine which is stopped while maintenance work is being carried out on the mechanism in the basement. Another advantage is the facility for scrap removal offered by the basement, to which reference will be made later.

UNDER-DRIVE PRESS DESIGN

Two basic drive mechanisms are employed on British Clearing under-driven presses, namely the direct eccentric and the rocker arm types. With the first of these mechanisms, the layout is similar

to that of a conventional, eccentric gear, top-driven press, with the intermediate and main driving shafts arranged parallel with the front face of the machine. At the ends of these shafts are the main eccentrics, which are located directly beneath the press uprights at each side. Long pitman beams connect the eccentrics to the press slide, and the action of the main slide is similar to that of a conventional crank press. All the under-driven presses installed at Vauxhall Motors are of this design. With the alternative arrangement, the intermediate and main driving shafts are disposed at 90 deg. to the front face, at the centre of the machine, and drive two geared eccentrics on a common axis. Pitman beams on these eccentrics are connected, at their outer ends, to rocker arms beneath each upright, and the rocker arms in turn, are connected to the slides by substantially-vertical links.

The rocker arms can be designed to impart a mechanical advantage which modifies the tonnage/stroke curve of the machine so that the force applied is considerably increased during the final ½ in. of the slide movement, at the cost of a reduction in the force available at other points in the stroke. This design has the advantage that sticking is avoided in the event of over-load, and a shear plate is provided in the slide mechanism to guard against excessive loading. With an under-driven press, the slide is pulled down towards the work, so that the load is taken by the connecting links in tension. Consequently, the need for pre-loaded tie bars which, in conventional top-driven presses, may be subjected to loads of more than twice the rated capacity, is avoided. In addition, it is possible to provide longer gibs with the under-drive design, and the resulting improvement in parallelism between bed and slide enables more accurate pressings and longer tool life to be obtained.

Most of the double-acting presses installed at the works of Vauxhall Motors are fitted with the Clearomatic clutch for the transmission of the drive from the motor, and a typical example is shown in Fig. 11, on the leading press in line *L*, Fig. 2. This press is of the 4-point suspension, double-acting type, with a bed of 84 by 48 in. and forces of 500 and 300 tons can be exerted by the main and blank-holder slides, respectively. The Clearomatic clutch was described in detail in MACHINERY, 86/372—18/2/55, and it is designed to provide a means of varying the speed of the eccentrics which move the drawing slide, automatically, during the press cycle. The clutch incorporates an epicyclic gear which is brought into operation towards the bottom of the downward movement of the slide to provide a normal slow drawing speed. Immediately drawing has been completed, the epicyclic gear is disengaged, and the slide is returned at a speed about 2½ times that employed for drawing.

This arrangement allows the press to be operated at about twice the speed of a machine not thus equipped, and enables the initial drawing operations to be carried out at rates which are comparable with the speeds of the single-acting presses employed for subsequent stages, such as piercing. Thus, delays on the press lines due to slow operation of drawing presses are avoided, and rates up to 12 strokes per min. can be maintained. Among other features of the British Clearing presses are the welded frame construction, which allows design variations to be easily incorporated at low cost, also provision for the adjustment of the slide nuts by means of a motor, controlled from the master

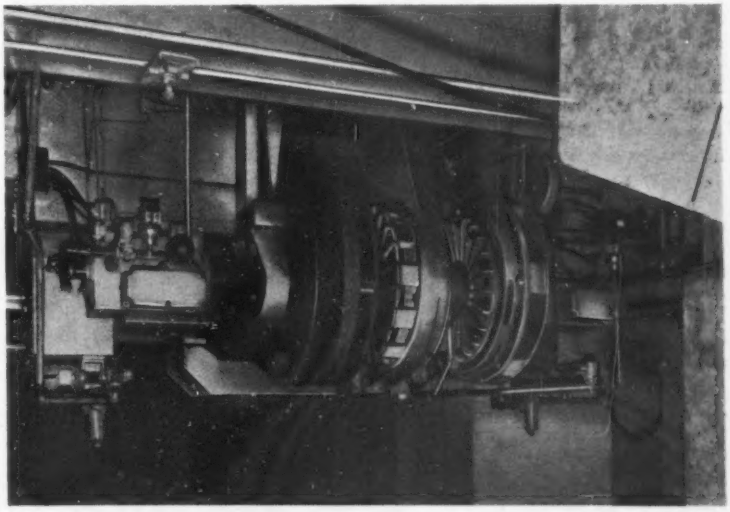


Fig. 11. Initial Drawing Operations on British Clearing Presses have been Expedited by the Fitting of Clearomatic Clutches, giving Normal Drawing Speeds with Fast Approach and Return of the Slides

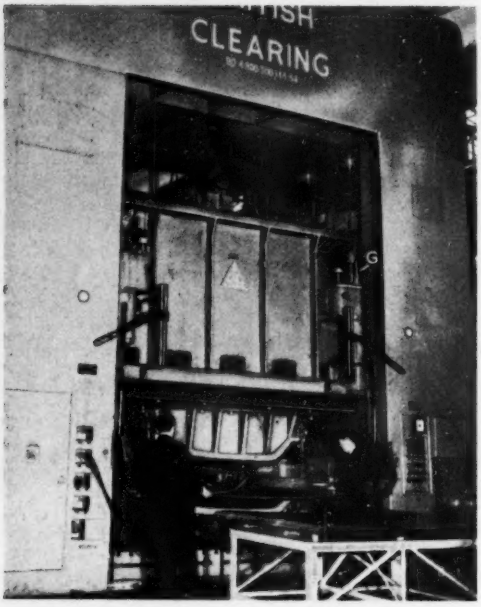


Fig. 12. Close-up View of the British Clearing Press at the Head of Line *K*, Fig. 2, Set Up for the First Drawing Operation on a Floor Pan Pressing, Showing the Position of the Blank-holder Slide Adjustment Gear and a Pressure Indicator at *G*

panel at the front right-hand face of the press. Automatic lubrication is provided by special metering systems which incorporate tubes containing helical inserts along which the oil passes in a spiral path, the longer spirals serving to reduce oil flow.

A closer view of one of the largest presses installed in the works, at the head of line *K*, Fig. 2, is given in Fig. 12, where the adjusting gear for the slide nuts may be seen at the top of the slide. On the double-acting presses, there is provision for accurate pinch adjustment of the blank-holder, by means of the equipment seen at each end of the slide in Fig. 12, which is duplicated on the other two corners, at the rear of the machine. This equipment also serves to prevent over-loading of the blank-holder slide. A diagram showing the arrangement of one of these units is given in Fig. 13, where the adjustment gear for one corner of the blank-holder slide is seen at the left-hand side.

From the diagram it will be noted that the adjusting nut *D* is seated on the piston, *E*, of a small hydraulic cylinder. This cylinder is connected to the upper end of a vertical intensifier cylinder, which contains a piston *F*. To the lower end of the piston *F* is secured the plate-type piston of a large air cylinder, and this piston carries an indicator rod *G*. The lower portion of a column behind the indicator rod is painted green, and the upper portion red, and both the rod and column are visible from the front of the press, and are indicated at *G* in Fig. 12. When a load is applied to the blank-holder to grip the work material, oil pressure is built up beneath the pistons *E* to a pre-set value, which is adjusted by varying the air pressure in the large intensifier cylinder by means of the regulator at the right in Fig. 13.

After the force applied to the blank-holder has reached the pre-set value, further downward movement results in an increase in the oil pressure beneath the piston, so that the intensifier piston is also moved down, lowering the indicator rod *G*. When the top of the rod passes below the green, and into the red, portion of the column, indication is afforded that excessive force is being applied to the blank-holder at that corner, and the air pressure in the intensifier is then adjusted accordingly.

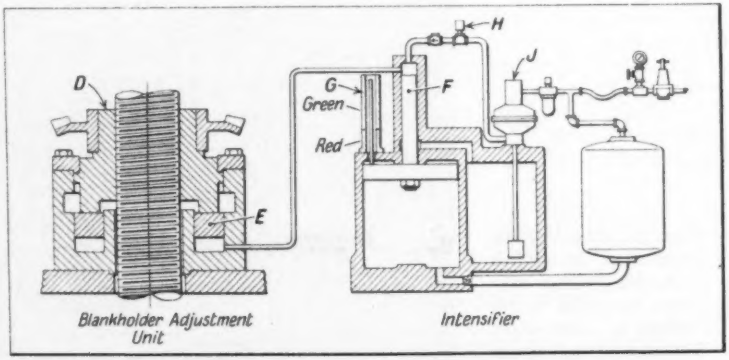


Fig. 13. Diagram Showing the Arrangement of the Blank-holder Slide Adjustment Unit Fitted to Each Corner of the Double-acting Presses. On Single-acting Presses these Units are Employed Solely for Overload Protection

The piston *E* can be moved downwards through a total distance of 0·12 in., of which the first 0·08 in. causes the indicator rod to traverse over the green portion of the column. The remaining movement causes the indicator rod to enter the red part of the column, and when the full movement has taken place, the intensifier piston *F* has been pushed down so far that the oil can escape through a port into the reservoir. Additional downward movement of the blank-holder up to ¼ in. is available after this point has been reached, so that it is virtually impossible to over-load the slide.

If there has been an increase in the pressure of the oil between the piston *E* and the intensifier piston *F*, it will fall off as soon as the slide starts to move up, and the pressure switch *H* will be operated, with the result that a red instead of a green lamp on the control panel is illuminated. At the top of the stroke, the clutch will be automatically disengaged and the air-driven hydraulic pump *J* will be energized to recharge the system, so that the press can operate again. In setting a die, the pressure required is adjusted by means of the regulators for each corner of the blank-holder. The pressure is determined during die proving, and is marked on the front of the tool. Any slight adjustments required are then easily made during the production of the first few panels. On the rams of single-acting presses, and the main slides of double-acting machines, similar units are fitted, and are inter-connected so that they act only as overload protection devices.

The master control panel for the press is seen at the right-hand side in Fig. 12, and it incorporates a key-locked selector switch for the selection of continuous or single strokes, inching, and shut off. After selection, the motions are initiated by push-buttons. Recesses at the lower corners of the press frame accommodate safety jacks for the slide, which are inserted when die maintenance or re-setting are to be carried out. These jacks take the form of tubular steel posts with square flanges welded to each end, and they are connected by chains to electrical plugs which are engaged with sockets within the recesses. When the jacks are removed to be placed beneath the slide, the plugs are also pulled out and the press control circuits are thus disconnected.

All the pneumatic equipment required for the operation of the drawing press, and of the auxiliary units associated with it, is combined in two neat installations within the press columns. The operation of such equipment as ejectors within the die during the up-stroke of the press, also of extractors and turn-over mechanisms, is effected by means of a unit of the type shown in Fig. 14, which is fitted in a recess in the rear face of one of the columns, behind a door. This unit is a rotary, cam-operated, multi-switch, with a vertical camshaft which is driven by gearing in synchronization with the eccentric shaft of the press, and it provides for the control of as many as nine different pieces of equipment. Each of the cams on the shaft, one of which is indicated at *L*, can be adjusted independently to any angular position when a clamping nut at one end of the shaft is loosened. In setting the unit, these cams are placed at approximately the positions required to operate the different auxiliary units at the required points in the press cycle, and the nut is tightened.

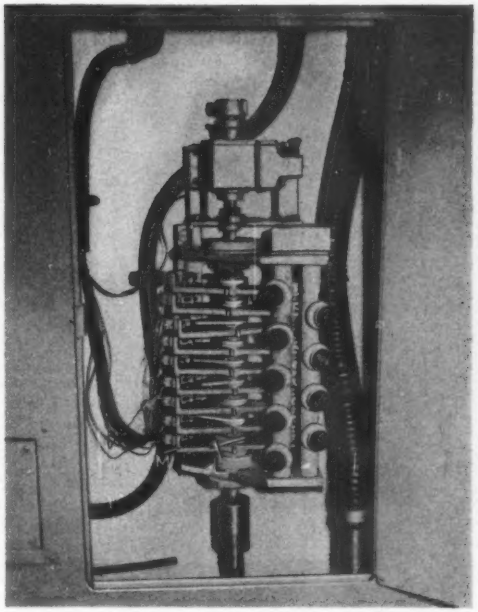


Fig. 14. A Recess in the Rear Face of the British Clearing Press Frame Accommodates this Rotary Cam Switch, Whereby the Operation of Auxiliary Equipment, Such as Unloading and Turn-over Units, may be Controlled

Final adjustment of the operating positions is then effected by moving the limit switches, which are mounted on the ends of cross bars *M*, supported on the camshaft. These bars are connected by swivelling, threaded bushes, to the ends of knurled-head screws, the heads of which are labelled to indicate the functions controlled by the various limit switches. Each cross bar can be turned, by means of its screw, through an angle of 30 deg. for this final adjustment. When the

Fig. 15. Near One End of the Press Shop are these Four Lines of Wilkins & Mitchell Presses of 200-tons Capacity, with Eight Presses in Each Line, Employed for the Production of Minor Body Pressings

auxiliary unit operated by a particular limit switch has been set to function at the required point in the press cycle, the knurled screw is locked in position by a nut. The limit switches can be employed to energize timing apparatus, to make and then break a circuit (using two switches), or to initiate the operation of a mechanism which is subsequently stopped by another switch on the mechanism itself.

WILKINS & MITCHELL PRESSES

At the end of the press shop on the right in Fig. 2, there is an area beneath which the basement does not extend, and here is installed a number of Wilkins & Mitchell single-point suspension presses of 200-tons capacity. These presses are employed for the production of the minor body pressings, and, again, are arranged facing the steel stores area, so that the work may flow through them from front to rear. A view of the installation from the front, looking towards the panel stores at the rear of the shop, is given in Fig. 15, and it will be seen that there are four lines, each of eight machines. All the presses are similar, and each is of tie-rod construction, the drive being taken through a direct-acting, air-operated, friction clutch-brake unit to double-helical geared eccentrics. An indicator is fitted at eye level to show the position of the eccentric, and also gives a reading of the tonnage applied at various positions of the slide.

Long ways on the slide, and phosphor bronze pads on the machine frame, provide for accurate guidance, and the weight of the slide is counterbalanced by air cylinders housed in the side columns. All the important points on the machine are lubricated by a centralized Duaflow high pressure system, incorporating two separate pump units to safeguard against failure. A pneumatic cushion may be fitted in the machine bed, and is of such a design that no pit is required beneath the machine. A component representative of those produced on these machines is seen in the close-up view in Fig. 16, taken from the front of the press. The pressing here seen at the extreme right has been produced by blanking and forming on two previous machines in the line, and is carried to the press shown, on a band-type conveyor.

This press provides for cropping the pressing into two halves to make the pair of bulkhead panel extensions indicated at *P*, and the tool is of straightforward design. As the machine slide rises, air is fed to the rear of the piston in the small ejector cylinder *R*, causing the ram to shoot out and propel both pressings out of the tool, into the two box pallets placed at the rear of the machine. A pin carried on a bridge member at the back of the tool ensures that the pressings are deflected in the correct directions, should this be necessary.

The majority of the tools fitted to these presses are provided with automatic air-operated unloading mechanisms of this type. In addition, provision is made for fitting interchangeable unloaders, of the swinging-arm type, to brackets at the rear

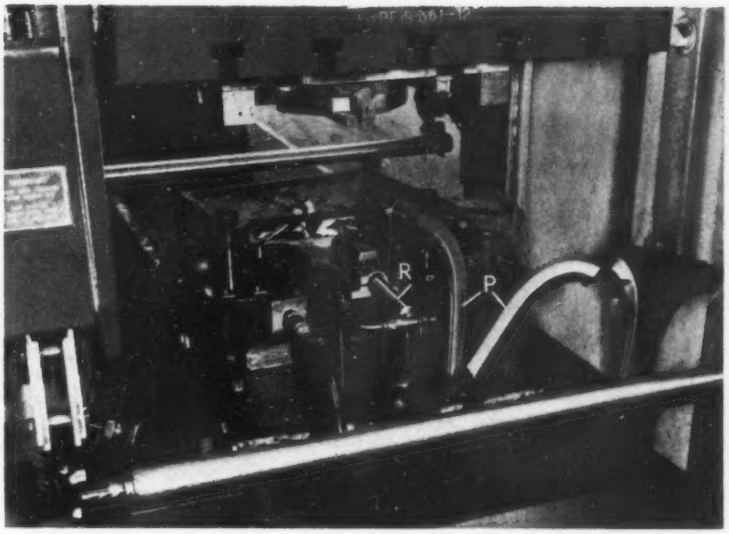


Fig. 16. Close-up View of a Typical Tool Employed on One of the Wilkins & Mitchell Machines for Cropping a Pressing into Two Parts, which Form Right- and Left-hand Bulkhead Panel Extensions

of each machine. Where practicable, these unloaders are provided with fingers which grip the panel to be removed, but they may, alternatively, advance a flat or rimmed pan to catch a blank as it is ejected from the upper tool by the knock-outs.

HORDERN, MASON & EDWARDS MACHINES

For the very small body components, a total of 36 H.M.E. inclinable presses, in addition to those in the steel store area, is installed at the extreme right-hand end of the press shop, as indicated in Fig. 2. These machines are arranged in staggered lines, side by side, and a view in the shop, looking towards the steel store, showing some of the presses, is given in Fig. 17. The presses are of the OP type, introduced for the International Machine Tool Exhibition in 1956, and described in MACHINERY, 88/1190—22/6/56, and they range in size from 45- to 75-tons capacity. Each is fitted with a pedal-operated sliding-key type clutch, incorporating the company's patented non-repeat mechanism, and has pneumatic balancing for the ram by means of an air cylinder at the rear. Most of these machines are employed for the production of components from off-cuts, and from strips produced from rectangular material on the guillotines.

Several presses, however, are arranged for the production of those parts that are required in large quantities, for instance, where several are required for each car, from coiled strip. A typical set-up is shown in Fig. 18, where a 55-ton press is engaged on the production of steering column

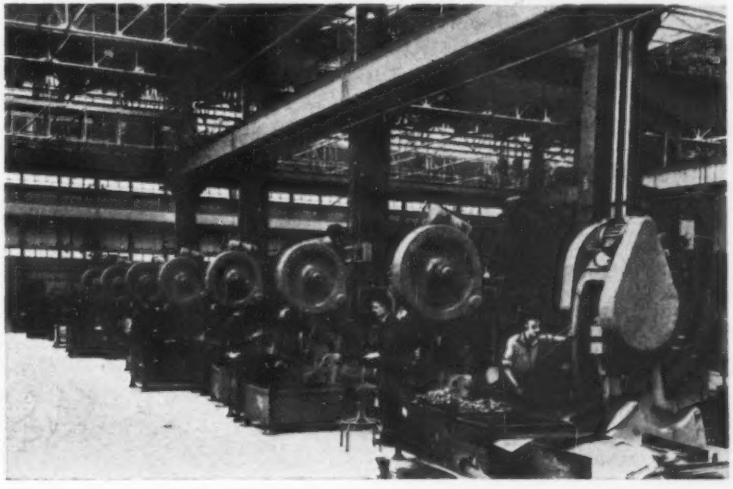


Fig. 17. More than 50 H.M.E. Inclinable Presses of Capacities Ranging from 45 to 75 tons are Installed in the End Bay of the Shop, as Shown Here, and at One End of the Steel Store Area

mounting spacers, from coiled stock material measuring 2 in. by 0·078 in., at the rate of 90 strokes per min. The coil is fed automatically from the holder and straightening unit at the right, which is one of several units supplied by the Press Equipment Co., Ltd. For operation on coil stock, the press is fitted with the H.M.E. roll feed unit which has an integral bed plate. This unit is mounted in place of the removable bolster normally supplied with the machine, and is operated by a link from the crankshaft. It may be noted that the machines are very well guarded.

SCRAP DISPOSAL

As mentioned earlier, the arrangement of the presses above an extensive basement has facilitated the provision of the most modern methods of scrap disposal. Arranged parallel with the lines of presses, in the basement, there are six multi-slat type conveyors, which run continuously when the press lines which they serve are in production. Each of these conveyors is 120 ft. long, and they are located in the spaces between the rows of concrete columns on which the presses are supported, so that one conveyor can serve at least two lines of machines. Sheet metal chutes are fitted to the underside of each machine to deliver the scrap off-cuts and trimmings to the conveyor, the dies being fitted with scrap cutters where required. This material is continuously transported to the far side of the shop, where it is deposited on one of a pair of similar conveyors which are arranged at 90 deg. to the press lines.

These two conveyors carry the scrap towards a point near the centre of the shop where there is a double-width conveyor, with a total length of 408 ft., on to which the material is discharged. The double-width conveyor leads back towards the steel store area of the shop, parallel with the press lines, passing beneath the stores and emerging inside the scrap baling house, indicated on the plan in Fig. 2. A view in the basement, showing this main scrap conveyor and some of the chutes leading down from those rows of presses which are able to feed straight to it, is given in Fig. 19.

In addition to the chutes delivering scrap from above, there are several Ryemor moving-band type auxiliary conveyors leading from the rows of presses at either side. These conveyors are easily moved, and can be arranged to transfer scrap from any point, as required.

Switches, operated by wires, are fitted at the sides of all the conveyors, and if the wires are contacted by excessive overhanging scrap, as may happen if there is a sudden discharge on to an already fully-loaded conveyor, the drive motor is automatically stopped. All the main conveyors in the basement were supplied by the New Conveyor Co., Ltd.

Over the run leading to the scrap baling house, the double-width conveyor rises to a level slightly higher than that of the press shop floor. A view inside the scrap baling house on this level is given in Fig. 20, where the end of the double-width conveyor is seen at the centre, having entered the room from the left-hand side. Scrap arriving on the conveyor falls off into a large rectangular hopper, which is divided into two halves by a movable

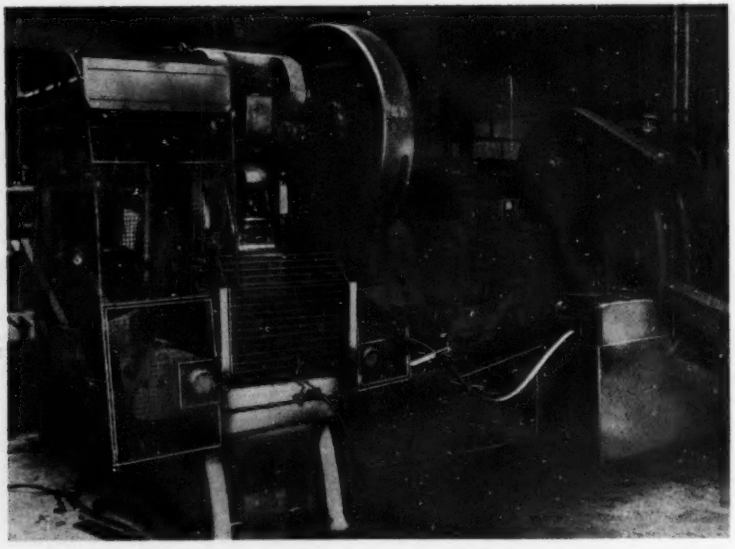


Fig. 18. Some of the H.M.E. Machines are Equipped with Crank-driven Roll Feed Units Having Integral Bed Plates which Replace the Normal Bolsters and are Employed for Producing Parts from Coil Material

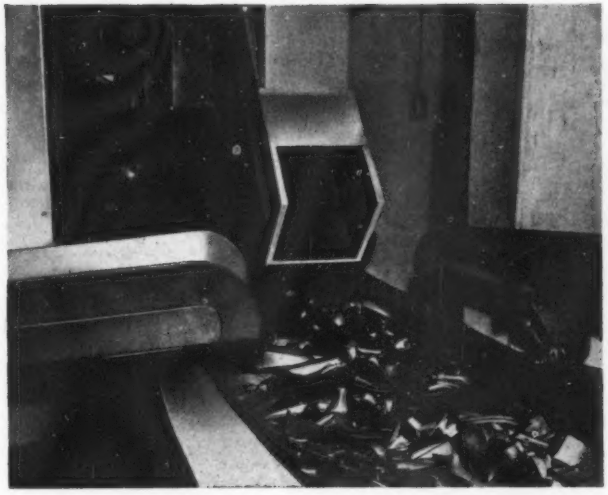


Fig. 19. A Series of Multi-slat Type Conveyors in the Basement Beneath the Presses Deliver Scrap Off-cuts to this Main Double-width Conveyor, which Feeds the Semi-automatic Baling Plant

partition. This partition, in conjunction with two further, short conveyors, allows the scrap to be delivered to the loading hoppers of either of two Lindemann hydraulic baling presses, which form a duplex installation on a floor which is on the same level as that of the press shop basement.

The baling machines are controlled by means of the electrical equipment seen on the left in Fig. 20, and one or both plants can be operated according to the amount of scrap to be dealt with. Under the control of a single lever, the three hydraulic rams of the machine, arranged at 90 deg. in the horizontal plane, are brought in, successively, to reduce the scrap charged into the box to a bale measuring up to 27 by 18 by 18 in. Of these three dimensions, only the width of 18 in. is constantly maintained, to allow movement by conveyor without danger of jamming, and the other measurements vary according to the amount of scrap charged.

Each bale of scrap weighs between 4 and 5 cwt., and, after compression, it is discharged from the machine by the continued advance of one of the pair of opposed rams. During this movement, the other ram of the pair is held in contact, hydraulically, with the opposite end of the bale, so that the latter emerges gripped between the two rams. When the rams are retracted, the bale drops on to a shuttle table on which it is advanced intermittently to another conveyor.

This conveyor is of the double-chain type, with connecting bars which push against the bales, causing them to slide along on the stationary sheet metal surface leading to the loading dock. Elaborate interlocking of the units is provided by means of micro-switches to prevent more than one bale being transferred to the conveyor at once. On leaving the conveyor, the upper end of which is at a level slightly higher than that of the average

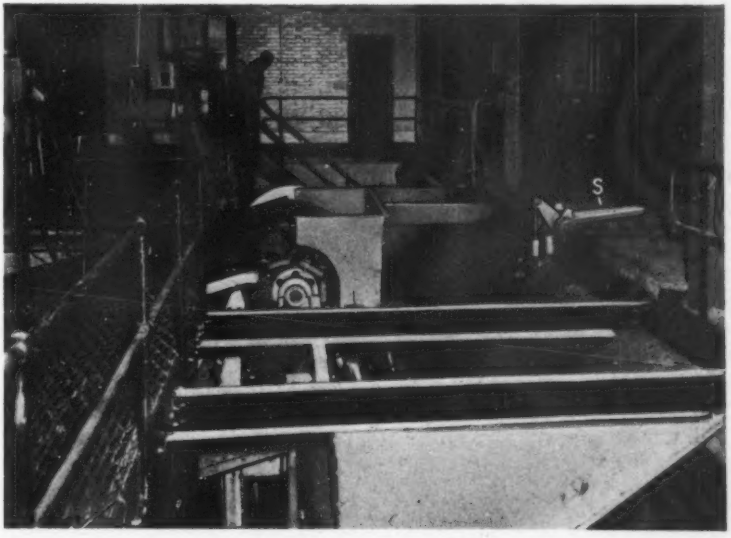


Fig. 20. In this General View in the Baling House, on One Side of the Steel Store Area, the Main Conveyor can be Seen Entering from the Left

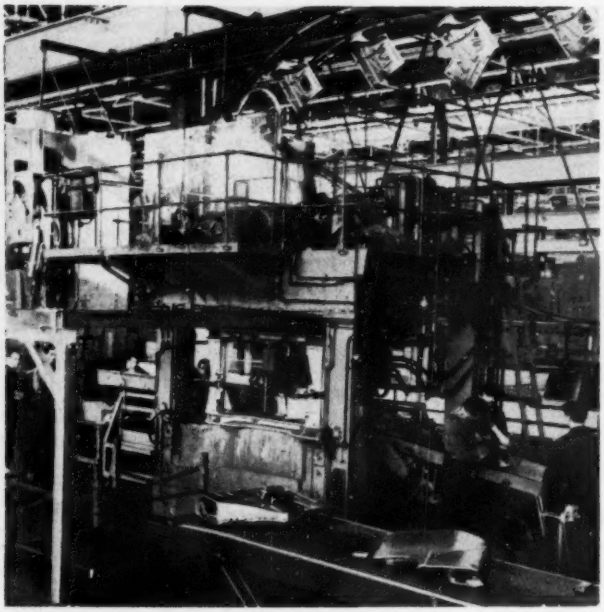


Fig. 21. British Clearing Welding Presses are Employed for Many of the Spot-welding Operations on Assemblies such as Doors, Boot Lids, and Floor Pans. This Particular Press is in the Door Line

lorry deck, the bales are pushed by an automatically-operated hydraulic ram along a flanged skid track on the floor of the loading dock. The building which houses this loading dock is situated outside the press shop, and can just be seen at the extreme right-hand side in the heading illustration. An entrance for lorries is provided, and they are backed-in for loading the bales, which is performed with the aid of an electro-magnet suspended from a travelling crane.

The electro-magnet is of rectangular shape, so that it can lift up to five bales at once, and has handlebars with control buttons for the magnet and the crane for ease in manœuvre. With this equipment, a load of 17 tons of scrap can be loaded on to a lorry in 20 min. by a single operator, without undue exertion. In addition to the material which enters the baling house on the conveyor, a certain amount of scrap is produced by the smaller presses in the shop, and this is normally collected, as it is produced, in box pallets.

The loaded pallets are then transported to the baling house on their own wheels, and are then emptied into the main hopper by means of the hydraulically-operated shoe, seen at *S* in Fig. 20. Each box is wheeled forward until a bracket on its underside is engaged with the shoe, which is then turned about its hinge point, near the edge of the hopper, to discharge the scrap. The movements of the shoe are controlled by means of push-buttons on the stanchion at the far edge of the opening, from which the guard rails have here been temporarily removed.

WELDING AND OTHER PRESSES

Several of the panels produced in the shop, notably for the eight different doors, are assembled before being passed to the conveyor which descends to a storage basement on its way to the body-building shop. Doors can thus be removed for storage, or allowed to continue into the shop, as required. As previously noted, the lines *A* and *B* in Fig. 2, which are headed by double-acting presses of 96 by 60 in. bed dimensions, are employed for door and boot lid manufacture exclusively. The inner door panel is made on line *A*, and passes through a maximum of five single-acting presses, of 84 by 60 in. bed dimensions, for the completion of the series of trimming, re-striking, piercing and forming operations. From the last press, the panels are hooked on to a mono-rail conveyor, for transport to the adjacent assembly line, which is situated at the end of the press line *B*.

The outer panels are made on line *B*, and pass through three single-acting machines, after the initial draw. At the end of the press operations, these panels are hung on another mono-rail conveyor, which carries them to the corner of the shop at the lower left-hand side in Fig. 2, where sound-deadening material is sprayed on to the inner surfaces. The panels continue on the same conveyor and are returned to the end of the press line where they are removed and assembled to the inner panels. Welding is carried out on British Clearing presses of the type shown in Fig. 21, which, again, are built by Vickers Armstrongs (Engineers), Ltd., and sold by the Rockwell Machine Tool Co., Ltd. This press has a table, measuring 90 in. square, which is raised to a fixed height each time the machine is operated. The crown of the press carries the mechanism for

moving the table, and it also supports the upper portion of the welding tool, the lower portion being carried on the table.

After the table has been raised to the operating level, the spot-welding guns are energized to make the welds, and the table is then lowered for unloading and the insertion of another assembly. Upward movement of the table is effected by means of a motor on top of the press, which drives a two-throw crankshaft through an air-operated clutch-brake unit. The crankshaft is located at the centre of the press crown, and its two throws are connected to levers on parallel countershafts, one at each end of the crown. When the crankshaft is turned through 180 deg., an angular movement of 90 deg. is imparted to the countershafts. Completion of the full revolution of the crankshaft then returns the countershafts to their original positions. At the outer end of each countershaft, there are additional levers, disposed at an angle of 25 deg. to those near the shaft centres, and the ends of these levers are attached, by links, to the corners of the table.

Thus, when the crankshaft is driven slowly through one complete revolution, the countershafts are oscillated through 90 deg. and the table is raised and lowered through a fixed stroke of 18 in. The clutch is disengaged automatically and the brake applied when the crankshaft has turned through 180 deg., and the spot-welding guns are then energised. Welding completed, the clutch is again engaged to drive the crankshaft through the remaining 180 deg. to lower the table for re-loading. The arrangement of the countershaft and levers, which are connected to the table, is such that they are horizontal when the table is lowered, and vertical when it is raised, so that the table is locked in the raised position by a toggle effect. Machined surfaces on the inner faces of the four fabricated-steel, square-section, support columns for the crown provide guideways for the table corners, which are also suitably machined. Details of the tooling employed on these presses for the assembly of specific components will be included in another article, to be published later.

With certain of the panels being produced in the shop, it is not possible to provide for a full tooling sequence with the fixed installation of presses. Modifications to designs, or practical tooling considerations, may necessitate the introduction of extra operations, for which there is no press available in the line, or which cannot be carried out on one of the British Clearing machines. In such instances, it is the practice to make use of smaller types of presses, where they are suitable, and a number of different machines have been provided. These presses are regarded as being transportable, and are self-contained so that they may be picked up with the overhead crane and placed in any convenient position in the shop. Among the presses employed in this manner are included Hi-Ton [Drummond-Asquith (Sales), Ltd.], H.M.E., and Craig & Donald (Scottish Machine Tool Corporation, Ltd.) machines, and a typical application is seen in Fig. 22.

This illustration shows a view of an installation near the end of line *J*, Fig. 2, which is tooled for the production of front wings for the Velox and Cresta cars. The wing being made is for the right-hand side of the car, facing the front, and

Fig. 22. Several Presses of the Transportable Self-contained Type, such as the Craig & Donald 100-ton Unit here shown, are Employed for Minor Operations which Cannot Conveniently be Performed on the British Clearing Machines

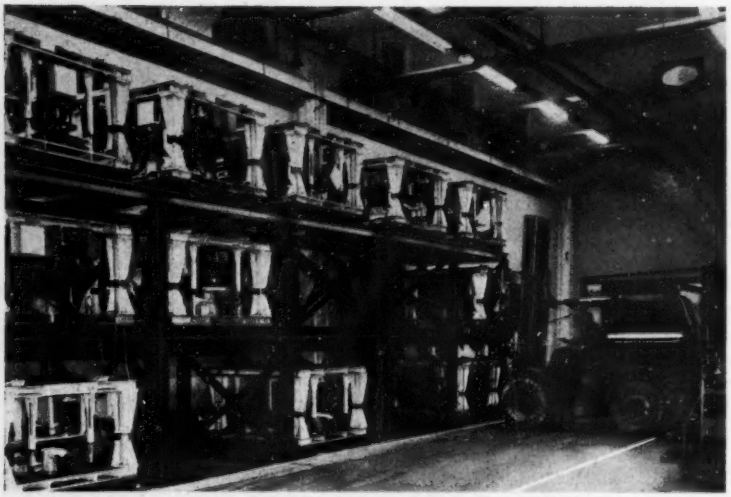


Fig. 23. Movement of Spot-welding Tools is Carried Out with a Freightlifter Fork-lift Truck, here seen Placing a Unit in the Storage Rack which is Located at One Side of the Panel Store

it is formed in a series of operations on the British Clearing presses in the line. From the last of these machines—a 400-ton press at the left—the wing pressing is transferred to the Craig & Donald 100-ton press seen at the centre of the illustration. This press is fitted with a tool which provides for punching four mounting bolt holes in the rear flange of the pressing, and it has hinged wire mesh guards which enclose the tool and the work, and must be closed before the press can be operated.

The special machine at the right in Fig. 22 is also self-contained and fully transportable, so that it can be removed when not required for this particular pressing. Made by J. Simpson & Son, Ltd., Luton, this air-operated press is employed for punching six pairs of round holes and one elongated hole in the upper surfaces of the wing (on the car), for the attachment of a chromium-plated decorative strip.

LOADING AND UNLOADING OF TOOLING

Fairly frequent tool changes must be made on most of the press lines and heavy tools are employed, some of which weigh up to 40 tons. Consequently, the subject of handling, loading, and unloading has been carefully studied. Tooling on the welding presses is comparatively light, and the various sets are so arranged that they may be fastened together with the aid of guide pillars at each corner. Brackets carrying rollers are fitted to the top of each tool, near the corners, and these rollers engage guide channels fixed to the underside of the press crown. For ease of tool handling, these channels are extended outside the press, as seen in Fig. 21, where they are supported by stanchions and a cross-member. When loading a tool, it is raised by the fork-lift truck, and moved forward until the rollers are engaged with the guide channels. The tool can then be pushed into the press by hand, or with the truck, and fixing bolts are screwed into holes provided in the under-side of the crown.

The table is then raised so that the lower portion of the tool can be bolted down and the clamps holding the upper and lower portions of the tool together are unfastened. Connections to power, air and water supply manifolds are next made, and the tool is ready to run. For unloading, the sequence is reversed, and the tool, which resembles a large die set, is easily handled with the aid of the Freightlifter (Shelvoke & Drewry, Ltd.) fork-lift truck seen in Fig. 23, where a tool is being placed in the storage rack. This truck is powered by a Perkins diesel engine and can lift 18,000 lb. at a distance of 24 in. from the fork roots. The brackets for the forks are so arranged that they may be moved 6 in. to each side of the central position, and the forks can also be adjusted, sideways, to afford access to locations which would otherwise present difficulty.

Provision is made for the maintenance and adjustment of the welding tools, the electrodes of which are subject to wear and require frequent checks, in an area adjacent to the storage rack shown in Fig. 23. This area is situated at one side of the panel stores at the rear of the press shop, and fabricated steel frames with guide channels at the same height as those of the welding presses are provided, on which the tools are hung. The lower half of each tool can be removed, for maintenance, with the aid of the fork-lift truck, and it is subsequently replaced in the same manner. Elevating platform trucks supplied by the

Yale & Towne Manufacturing Co., and Lansing Bagnall, Ltd., are employed for the movement of the lighter press tools. An example of a Yale truck being used, in conjunction with the overhead crane, for loading a die, weighing 4 tons 6 cwt., on a British Clearing 400-ton, single-acting press, of 84- by 48-in. bed dimensions (in line *H* Fig. 2), is shown in Fig. 24. This die, it may be noted, is employed for the final flanging operation on right- and left-hand front seat cross-member support pressings.

The Yale truck is employed mainly for moving the die into and out of the press, and for this purpose the platform is equipped with a chain-driven shoe, as seen at *T*, at each side. These shoes are employed for moving the tool on the truck platform, which is first adjusted to a level slightly above that of the press bed, when loading is to be carried out. It may be noted that an advantage associated with the use of the basement for mounting the presses is that the bed level can be arranged at any desired height. Normally, the main consideration governing the bed height is the convenience of the operator feeding the material. For unloading, the platform is set slightly below the bed level, and the shoes are connected to the die by means of the short lengths of chain, with hooks, seen on the truck. The shoes are then moved away from the press to pull the tool off the bed on to the platform, and the crane can then be used to lift the tool clear.

Each bay of the press shop contains two or more press lines, according to size, and is served by a Carruthers crane of 30- or 50-tons capacity, depending on the weight of the tools employed on the presses in the particular bay. These cranes provide for most of the transport of equipment in the shop, including the movement of the presses mentioned earlier and the press tools. When a die change is to be made on a line, all the tools and other equipment required are brought out of the stores and placed on the floor beside the appropriate presses, during the last few hours of production of the previous component. The clean floor of the shop permitted by the basement layout is thus put to effective use, and economies in setting time are obtained. Setting of a single-acting press normally occupies about 1 to 1½ hours, and the time for a double-acting drawing press is approximately 4 hours, if no unforeseen difficulties are experienced.

Many of the dies employed on the double-acting presses are extremely heavy, and cannot be handled in the manner described. The heaviest dies are used on the leading presses in lines *J*, *K* and *V*, Fig. 2, and in front of each of these machines provision is made for fitting pulley blocks in the floor, so that the overhead crane may be employed to move the tool out of the press. By reason of the basement layout, the press beds are only just above floor level, and the manipulation of heavy tools is thus considerably facilitated. Transport of heavy tools between the die shop and the press is accomplished with the aid of the equipment seen in Fig. 25, where a tool for producing bonnet pressings for the Velox and Cresta cars is shown being unloaded from its transporter, between lines *J* and *K* Fig. 2, by means of a 50-ton crane. This die, together with the gap reducer plate at the top, weighs about 30 tons. The transporter has

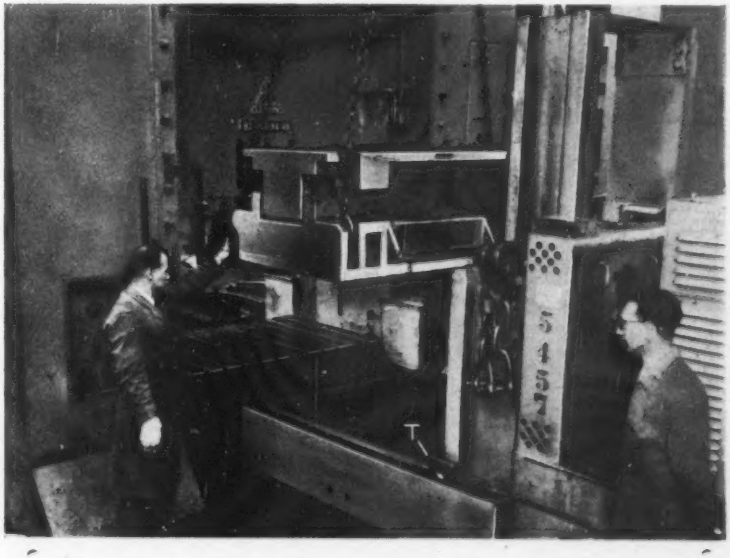


Fig. 24. Loading and Unloading of the Lighter Tools from the British Clearing Presses is Performed with this Yale Electrically-powered Platform-type Truck in Conjunction with the Overhead Crane

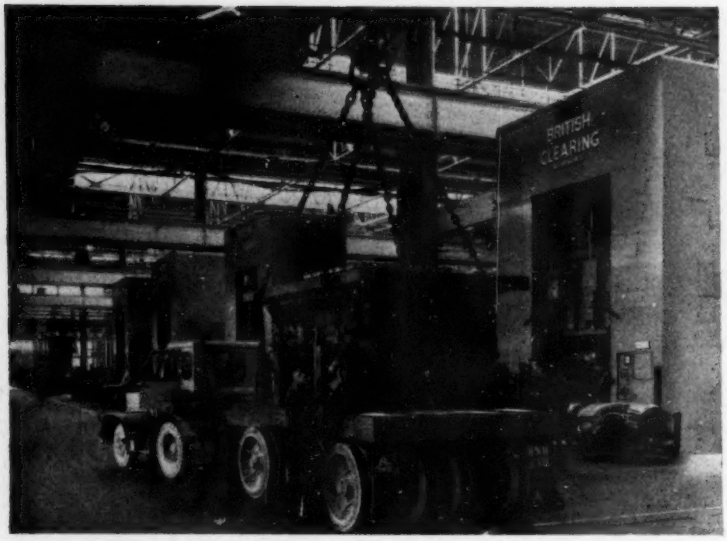


Fig 25. Unloading a Tool Weighing Approximately 30 tons from the Special Transporter Employed to Move it from the Die Shop. The Transporter is Drawn by a Mercury Diesel-engined Tractor

three axles, each with two pairs of double wheels with solid rubber tyres, the front axle being arranged to swivel for steering. It is drawn by a Mercury tractor, equipped with a diesel engine of about 100 h.p.

SCHULER AUTOMATIC TRANSFER PRESSES

On the side of the shop opposite to the steel store area, at the ends of lines *L*, *P*, and *R*, Fig. 2, there are three Schuler (Pearson Panke Ltd.), automatic transfer presses. Each of these machines has a maximum total capacity of 300 tons, with nine tool stations, and is designed to operate at a fixed speed of 15 strokes per min. The machines can be fed with strip material up to a maximum width of slightly less than 14 in., or with blanks up to about 12½ in. diameter, from magazine units. A general view of the press at the end of line *P*, Fig. 2, looking towards the steel store, and with the eight top-driven single-acting presses of line *Q* at the left, is given in Fig. 26. In this view, the driving mechanism for the press, which is equipped with a motor of 68 h.p., is seen on top of the machine. When coil material is used, it is fed from a holder through a levelling unit which is separate from the press. The strip passes through a gripper roll feed unit built into the left-hand upright of the machine, as viewed from the front, to the blanking station, and the blanks are subsequently fed sideways by the transfer mechanism.

Strip material, from which the blanks have been produced, passed through a slot in the rear of the press column, and is chopped-up by a built-in guillotine on the further side, so that the scrap is easily handled. Most of the 12 different components produced on the three machines are for the mechanical units of the cars, and some examples are shown in Fig. 27. It is hoped, in a later article, to discuss the tooling employed and the components produced, so that only a brief reference will be made here. The components in the front row in Fig. 27 are V-pulleys, and are produced by an interesting series of drawing and reducing operations. At the left of the middle row is one of a pair of right- and left-hand suspension coil spring housings, and in the centre, a brake drum web which is designed to be cast in position in the iron brake drum. At the right is a shock-absorber housing, of deep-drawn tapered form, produced by a series of six drawing operations, and at the rear, a timing chain cover and a hub cap, the latter being required in very large numbers. The varied shapes of these components affords some indication of the versatility of these transfer presses.

FEEDING AND TRANSFER OF MATERIAL BETWEEN PRESSES

Mention has already been made, in connection with Fig. 12, of the automatic units developed by the company for feeding flat sheets of material to the double-acting drawing presses. These units, in most instances, have been designed for use with specific panel blanks, so that they usually accompany a particular tool when it is installed for production. A typical unit for this purpose, employed on the heading press in line *B*, Fig. 2, for the production of outer door panels, is shown in Fig. 28. The unit has a frame of weld-fabricated steel angle- and channel-section material, the

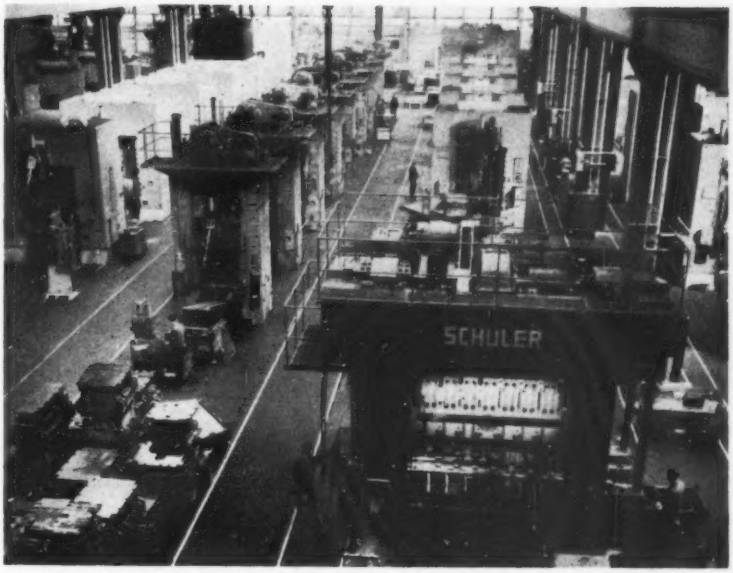


Fig. 26. General View in the Press Shop Looking Towards the Steel Store and Showing One of the Three Schuler Automatic Transfer Presses which are Employed Mainly for the Production of Components for Mechanical Units

height of which can be adjusted, by means of screw jacks fitted to the base, to suit the installed height of the tool. At the top of the unit, there are sheet metal surfaces and sides to support and guide the material, and between these surfaces is the feed mechanism.

This mechanism consists of a framework, usually of tubular steel construction, parts of which have movements in two directions. For the first of these movements, the main frame is supported on link members at each end, and is connected to an air cylinder, the arrangement being such that when the ram is extended the links are caused to swivel, and the framework is raised through a distance of about 2 in. On this main frame is carried the secondary frame, which moves longitudinally to feed the sheet of material into the tool. The secondary frame is powered by a long-stroke air cylinder, and the stroke length is doubled by the use of the well-known double-rack and pinion mechanism. Supply of air to the two cylinders is controlled by limit switches and solenoid valves so that the horizontally-moving frame is first lifted, to raise the sheet from its supports, moved forward, lowered, to deposit the sheet in a position nearer to the tool, and finally returned to the start position.

The length of the horizontal movement of the frame is sufficient to advance the freshly-loaded sheet of material from the front of the unit, where it is placed by the operator, to the central position indicated at *U*. As the frame returns, the sheet is

Fig. 27. Some Examples of Work Produced on the Schuler Transfer Presses which Include V-pulleys, Brake Drum Webs, Shock Absorber and Coil Spring Housings, Timing Chain Covers and Hub Caps

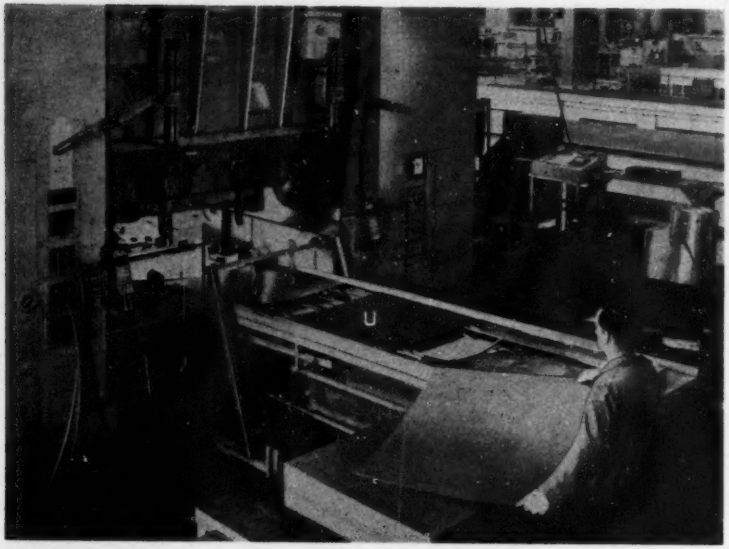


Fig. 28. One of the Automatic Loading Units Employed for Feeding Flat Sheets in a Horizontal Position. The Example Shown is Installed at the Head of the Line for Producing Door Outer Panels

held in position by projections on the supports, and at the next operation of the unit, the sheet at *U* is carried forward until its leading edge comes into contact with the positioning posts on the front of the draw ring of the tool. Finally, the next movement of the feed unit places the sheet in the tool, where it is held by projections while the feed frame returns. In practice, the press is connected to a push-button type of switch placed beneath the position occupied by the newly-loaded sheet at the operator's end of the unit. Thus, when the sheet is placed in position the press cycle is automatically initiated, and the operator can control the machine by the rate at which he places successive sheets in position. An emergency stop button for the loader and the press is also fitted near the operator's position.

In addition to the straightforward feeding of a flat sheet of material in a horizontal position, which represents the simplest requirement, units have also been designed for feeding sheets at an angle to suit the tools. For instance, where the tool surfaces are substantially inclined it may be preferable to feed the sheet at about the same angle, so that the material does not fall into place with the risk of being misplaced in the tool. Pressings such as bonnets or boot lids, for instance, are bent near one edge at an angle of about 90 deg., and the feeding units for these panels are arranged to perform a bending operation before placing the sheet in the tool, to simplify the drawing of the required form. On almost all the presses, extraction equipment, in the form of air-operated swinging arms, carried on brackets at the rear of the machines, as seen in the background in Fig. 26, is employed for the removal of pressings from the tools.

Such an arm can be fitted with a variety of gripping fingers, and its movements are synchronized with the opening of the press so that it swings down, grips the edge of the part, and pulls it out of the tool, usually before the ram has reached the fully-raised position. As the arm moves back, the fingers are automatically opened, so that the pressing is deposited on a flat belt conveyor on which it travels to the next machine. Such conveyors, one of which was discussed in connection with Fig. 5, are provided in a number of different sizes and designs, notably by Ryemor Engineering Co., Ltd. Where a drawn panel is required to be turned over before being loaded into the next tool in the line, an automatic unit, controlled in the correct sequence by a cam switch of the type shown in Fig. 14, is provided. Such a unit incorporates an inclined framework, fitted with rubber rollers to avoid marking the panel, down which the pressing slides until it is held at an angle of about 45 deg. An air-operated arm then swings forward and pushes the panel over, so that it falls on to the end of the inclined conveyor leading to the next machine.

The body-assembly building and press shop are notable for the high quality of the lighting, both during the day and after dark. In the press shop roof, which has a maximum height of 56 ft. and a clear height of 47 ft., the windows provided represent 35 per cent of the total plan area. At night, this area is illuminated by a system of twin 125-watt fluorescent units, each 8 ft. long, which provides a general level of 30 lumens per sq. ft. Each of the presses in the shop is equipped with

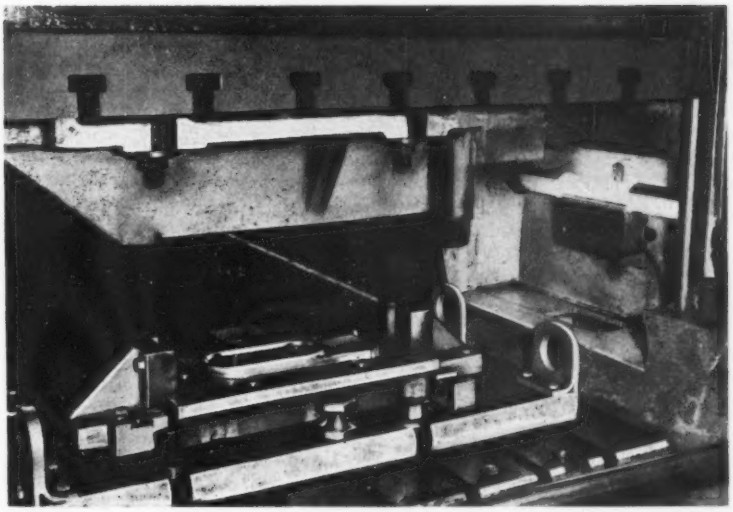


Fig. 29. Almost all the Presses in the Shop are Fitted with Presslites which Incorporate High-efficiency Fluorescent Tubes and Enable Very Neat Installations to be Provided

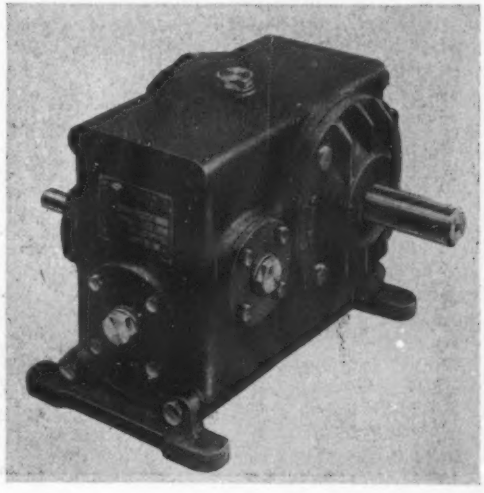
Presslites, supplied by the Britannia Engineering Co., Luton, as seen in Fig. 29, which shows an installation on one side of a British Clearing top-driven press of 250-tons capacity, equipped with a tool for producing a front side grille panel. These lighting units, which incorporate fluorescent tubes of high efficiency, fit snugly into frame recesses at each side of the ram, and are fully enclosed so that they are virtually unaffected by oil or grease. On the H.M.E. presses, the units are fitted at the rear of the bed, between the uprights, to illuminate both the tools and the work.

David Brown Radicon Double-reduction Worm Gear Unit

The illustration shows the latest addition to the David Brown Radicon range of worm gear units, which are built in various types and sizes from 1⅝ to 28 in. centres. This new 2¼-in. double reduction worm reducer is built by David Brown Industries, Ltd., London Gear Division, Stonebridge Park Works, North Circular Road, N.W.10.

It is designed for low-powered, slow-speed drives, and there is a choice of 53 ratios between 65:1 and 3,600:1, with output torques from 1,270 to 3,300 lb. in., at input speeds from 500 to 3,000 r.p.m. The standard ratios of the 1⅝- and 2¼-in. single reduction units are combined to provide this extensive range, and the single reduction unit gears are employed, except for the second reduction wormshaft.

Detachable feet are fitted, and alternative facings enable the unit to be mounted in a number of different operating positions. Case-hardening steel is used for the worms, which are precision ground after hardening, and the centrifugally-cast bronze worm wheels are pressed and keyed on to the intermediate and low-speed shafts. Dual-purpose bearings are fitted throughout, and the cast-iron case is dust-proof and oil-tight. Cooling is by natural convection, and the gears and bearings are splash-lubricated.



Radicon Double-reduction Worm Gear Unit

Continuous Casting of Steel

At the plant of Low Moor Alloy Steelworks, Ltd., experimental work in connection with the continuous casting of steel was begun in 1946. As a result of these investigations, a satisfactory technique has been developed for the production of a wide range of high-quality steels in various forms.

The continuous casting machine now employed is about 50 ft. high, of which some 35 ft. is below ground level. It is fed from a standard steel ladle with metal melted in electric arc furnaces. The steel, which is at a controlled temperature determined with the aid of an immersion thermo-couple, is poured into a tundish with one or more refractory stoppers for controlling the metal flow into the water-cooled mould or moulds. A general view of the upper portion of the machine with pouring in progress, is given in the accompanying figure.

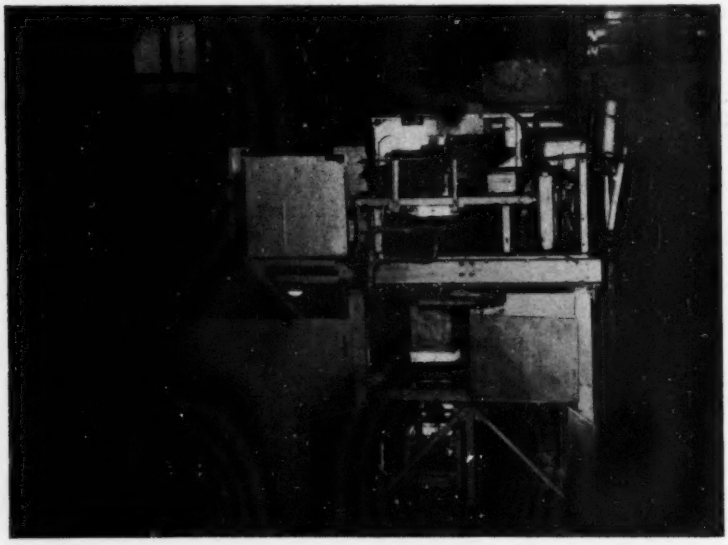
Initially there is a dummy plug in the bottom of each mould. This plug is withdrawn at a predetermined suitable speed and is followed by the partially-frozen steel bar. The steel section, which at this stage is still liquid internally, is guided by rolls and follows the plug down through the machine past water cooling units. Eventually, the solidified bar is cut into the desired lengths which are mechanically hoisted back to floor level. Specially-adapted electronic equipment is provided at various control points to enable any necessary adjustments to be made.

With the existing machine, squares and rounds from 3½ to 5½ in. can be cast in moulds with single or double openings. Larger slabs and special cross-sections can be produced if required.

The quality of the product is under constant survey, and it has been found that the steel is sound both internally and on the surface, and that it has a well-defined and evenly distributed grain structure which is at least equal to, and often better than, that of a small ingot.

All types of steel can be cast by this process, but a careful study of each grade is necessary before satisfactory results can be ensured. Among the important variables are:—(1) the thermal conductivity of the steel; (2) the temperature of the steel; (3) the speed of casting; and (4) the billet size.

The following are some of the advantages of the continuous casting process:—reduced capital costs for heavy forging, rolling and auxiliary plant; reduced scrap and wastage; reduced manipulation cost, labour and handling; increased productivity; increased yield; and shortened processing programmes.



A View of the Low Moor Continuous Casting Machine for Steel, with Pouring in Progress

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THE PRODUCTION OF FRACTIONAL-HORSEPOWER ELECTRIC MOTORS during January of this year reached a total value of £1,044,000, of which motors to the value of £192,000 were exported. For comparison, the figures for the corresponding month of last year were £1,038,000 and £233,000.

INA Needle-type Self-aligning and Thrust Bearings

Ina Needle Bearings, Ltd., Dafen, Llanelly, Carmarthenshire, who are sole concessionaires for the German firm Industriewerk Schaeffler, have added a number of new items to the already extensive range of Ina needle bearings and

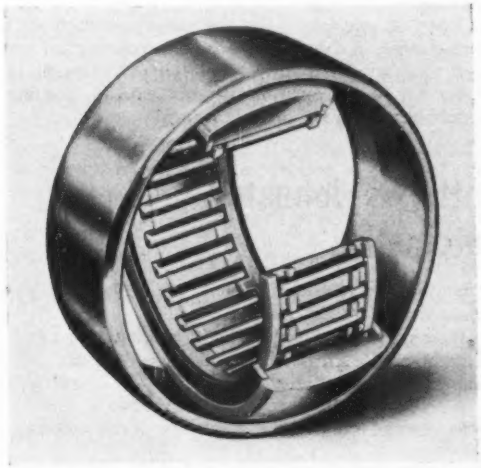


Fig. 1. An Example from the Range of Ina Self-aligning Needle Bearings

assemblies. Fig. 1 shows an example from a range of self-aligning needle bearings which is now available in sizes to suit shafts from 15 to 45 mm. (0·590 to 1·772 in.) diameter.

The construction of the needle and cage assembly, and the outer race and side retaining rings, is the same as for normal Ina needle bearings, except that the periphery of the outer race is of radiused form. The housing ring, in which the bearing is mounted, comprises a precision drawn steel

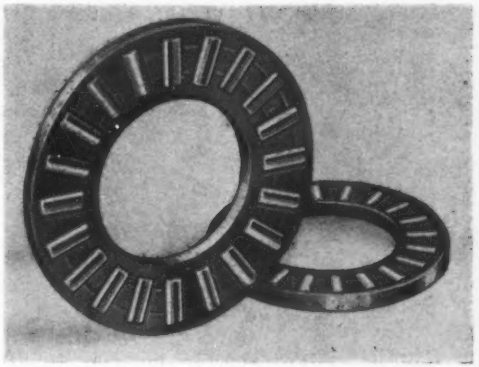


Fig. 2. Ina Needle Thrust Cage with 2-mm. Diameter Needles. These Thrust Cages are Available in a Range of Sizes

shell, incorporating two support rings, which form the radiused seating for the outer race. Self-aligning bearings of this design can also be supplied with inner races, suitable for shafts from 12 to 40 mm. (0·472 to 1·575 in.) diameter.

Needle thrust cages of the type shown in Fig. 2, designated series AXK, have been introduced, which incorporate 2-mm. diameter rollers, and are available in six sizes with outside diameters ranging from 28 to 68 mm. (1·102 to 2·677 in.) and bore sizes from 15 to 40 mm. (0·59 to 1·575 in.). Plain, hardened and ground steel thrust washers can be supplied for use with these needle cages. Alternatively, the thrust may be taken on components of the assembly in which the bearing is employed. A typical application, to a cluster gear mounted on a stationary spindle, is shown in Fig. 3.

Reference may also be made to the series KR

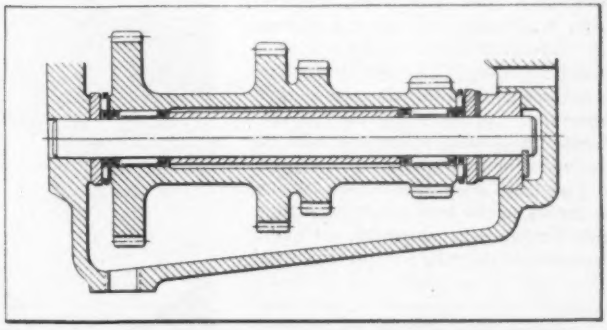


Fig. 3. Application of Ina Needle Bearings and Thrust Cages to a Cluster Gear and Shaft Assembly

M

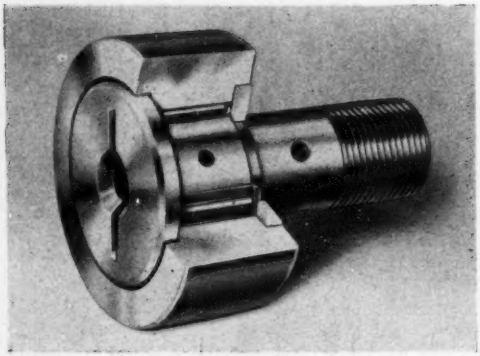


Fig. 4. Ina Series KR Cam Follower. These Units Can be Supplied with Following Rollers Ranging from 16 to 52 mm. Outside Diameter

needle bearing cam followers, of the form shown in Fig. 4, which comprise complete assemblies, ready for mounting. They are available fitted with following rollers ranging from 16 to 52 mm. (0·63 to 2·04 in.) diameter by 11 to 24 mm. (0·433 to 0·945 in.) wide, and the threaded shank diameters range from 6 to 20 mm. (0·236 to 0·787 in.). The periphery of the roller is slightly crowned, to avoid the possibility of edge loading, and the design of the assembly is such that the needles are completely protected against the ingress of dirt.

Because of the compact design of needle bearings, only a small annular space is available for fitting a seal, and standard types of seals are not generally suitable. A range of seals, known as the series SD, has therefore been introduced by the company, which can be used with all Ina shell type bearings, and needle bearings without inner races.

These seals are suitable for operation at temperatures up to 90 deg. C., and at shaft speeds as high as 1,500 ft. per min. For the same reason, special spring clips, of the required small cross-section, are now also available, in a comprehensive range of sizes, for axial location of Ina needle bearing assemblies on shafts or in housings.

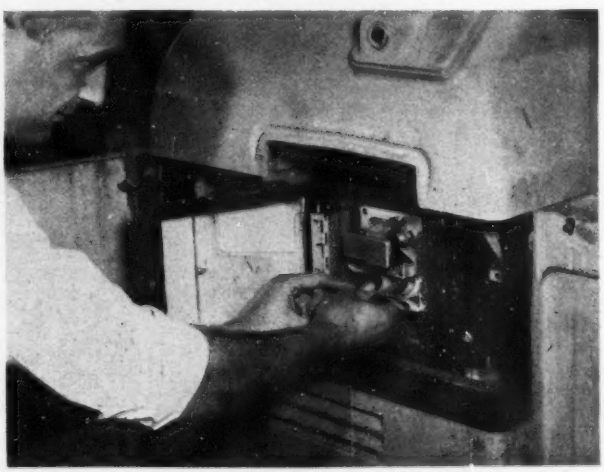
Tape Control for Potter & Johnston Chucking Automatics

It is announced by the Potter & Johnston Co., Pawtucket, R.I., U.S.A., that tape control can be provided, as an optional feature, on new 3U, 4U, 6 DRE 40, 8U, and 10U chucking automatics. Existing lathes of these types can be converted to tape control operation, if required.

With this system, set-up time is substantially reduced, and cycle times are kept to a minimum. After a programming sheet has been prepared from a drawing of the component, the information is transferred to a punched tape. The ends of the tape are then joined together so that it forms a continuous belt. Cycle repetition is thus obtained without the need for re-winding.

The tape is inserted in the reader, as shown in the accompanying figure, and the machine is set for automatic operation. Starting, stopping, rapid traverse, and speed and feed changes are then controlled from the tape.

Burton Griffiths & Co., Ltd., Mackadown Lane, Kitts Green, Birmingham, 33, are agents and licensees for the Potter & Johnston Co.



Close-up View Showing the Punched-tape Reader on a Potter & Johnston Chucking Automatic

Gauges for Checking Workpieces with Conical Ends

By CHARLES MINAIRE*

The gauge blocks shown in Fig. 1 have been developed to facilitate measuring the lengths of the cylindrical portions of workpieces, with conical ends of 90 or 120 deg. included angle. Each block incorporates a V-section location groove, the included angle of the groove in the block *A* being 120 deg., and in the block *B*, 90 deg. The blocks are made from tool steel, hardened and ground, and they are cut away, so that they can be assembled, as shown. Care is taken to ensure that, when the blocks are assembled, the axes of the V-grooves lie in the same vertical plane, and at 90 deg. to each other.

A workpiece to be checked is mounted in the assembled blocks, its cone end resting in the V-groove of the corresponding angle, and the other V-groove supporting the cylindrical body of the part. The arrangement for a part with a 90-deg. cone end is shown in Fig. 1, and for a part with a 120-deg. cone end, in Fig. 2. The distance *H* for each block can readily be determined after the blocks have been made, before they are put into use, and the height *V* of the plain end of the workpiece above the top surface of the seating block, can be measured with slip gauges. For a workpiece with a 90-deg. cone end, the dimension *h* to be measured can be determined from the expression

$$h = H + V - r$$

and for a workpiece with a 120-deg. cone end, from the expression

$$h = H + V - 0{\cdot}57735\ r$$

where *r* is half the diameter.

It is often necessary to check large numbers of workpieces to determine the position of a particular datum diameter along a cone, with reference to the plain surface at the opposite end. A typical workpiece is shown in Fig. 3, with a cone end of included angle 2α, and a datum diameter *d*, which is at a distance *H* from the plain end of the piece. For checking such a part, a special gauge of the type shown in Fig. 4 offers certain advantages.

* Chief of Metrology, National Arms Factory, St. Etienne, France

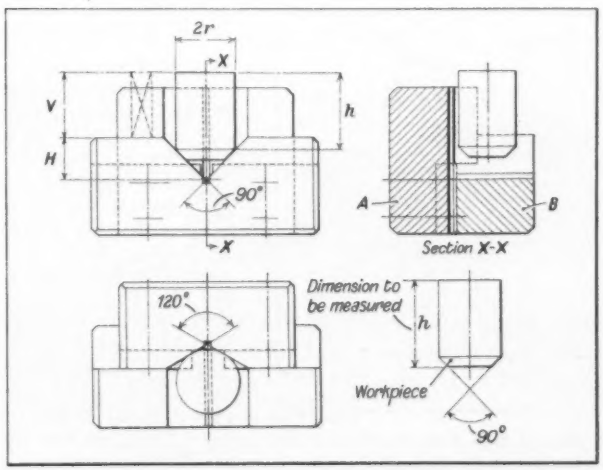


Fig. 1. A Gauge, Comprising Two V-blocks, which Provides for Measuring the Length of the Parallel Portion of a Cylindrical Workpiece with a Cone End

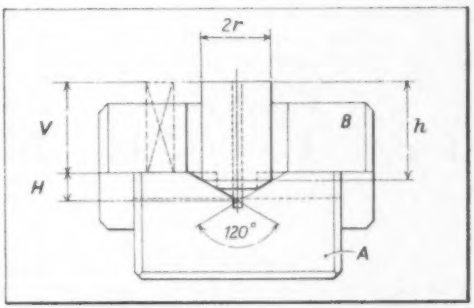


Fig. 2. The Gauge has V-grooves of Different Included Angles, and when Used as Shown, with the Workpiece Located in the 90-deg. Groove, Provides for Checking a 120-deg. Cone

The gauge has a base member *C*, made from alloy-steel, which is heat-treated and stabilized, and the lower surface of the base is finished smooth and flat. There are two anvils on the base, which may be faced with tungsten carbide, and the gauging surfaces, indicated at *D*, are set at an angle α to the vertical, this angle being half the included angle of the conical form that is to be checked. A guide member *E* is mounted at the rear of the base, and ensures that the workpiece is positioned with its axis truly vertical. A circular aperture is cut in this guide member, so that the mating surfaces of the workpiece and the gauge can be viewed against a light source, to determine whether or not the piece is seated correctly between the anvils.

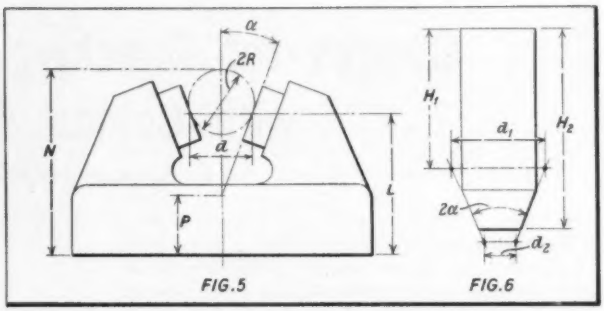


Fig. 5. The Height *L* is Calculated from the Distance *N* from the Base to the Top at a Roller. Fig. 6. The Gauge Shown in Fig. 4 Can be Employed for Checking the Position of a Datum Diameter, even when it is Located Beyond the Cone Portion on the Workpiece

From Fig. 4, it will be apparent that the height *M* of the plain end-face of the workpiece above the seating face of the base *C*, can readily be determined, and from *M*, the distance *H* can be found, if the dimension *L* is known. The dimension *L* is the distance of the datum diameter from the seating face of the base, and is determined as follows. A roller, of diameter 2*R*, is placed between the anvils, as indicated in Fig. 5, and the dimension *N* is measured. The roller diameter (2*R*) should be approximately equal to the value *d* sec α. The distance *P*, from the apex point of the angle α to the base seating face, can be found from the formula

$$P = N - (R + R.\text{cosec } \alpha)$$

Then, the value of *L* is obtained from the formula

$$L = P + d.\cot \alpha/2$$

It should be noted that this method of checking can be employed even if the datum diameter lies outside the limits of the conical end, as indicated in Fig. 6. Here, H_1 is determined from the expression $H_1 = M - L_1$, and H_2 from the expression $H_2 = M - L_2$, where $L_1 = P + d_1.\ \cot\ \alpha/2$, and $L_2 = P + d_2.\ \cot\ \alpha/2$.

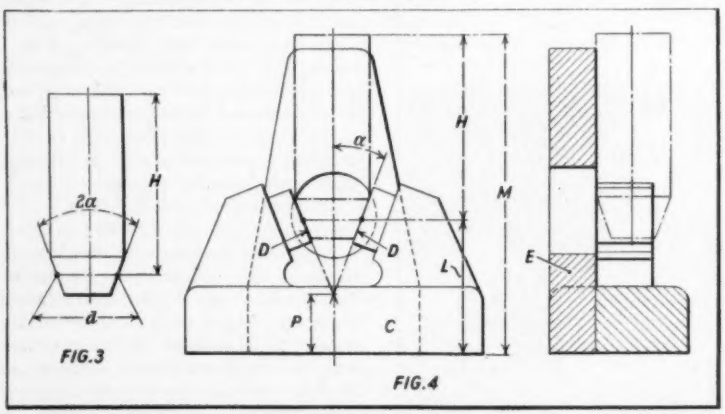


Fig. 3. On Certain Workpieces, it is Necessary to Determine the Position of a Datum Diameter on the Cone Portion, Relative to the Plain End of the Piece. Fig. 4. This Gauge is Designed to Facilitate the Measurement of the Distance from the Plain End of a Workpiece to a Datum Diameter on the Cone Portion

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PELOX WELD-CLEANING FLUID.—North Hill Plastics, Ltd., Manley Court, Stoke Newington High Street, N.16, have developed a weld-cleaning fluid, known as Pelox, for use with stainless-steel, and certain high chromium and nickel alloys. After the fluid is applied to the discoloured area, the metal is polished with a rotating stainless-steel brush. The treated area has a matt finish, and any surplus fluid can be removed with a sponge and water. Pelox is non-corrosive and contains no skin irritants.

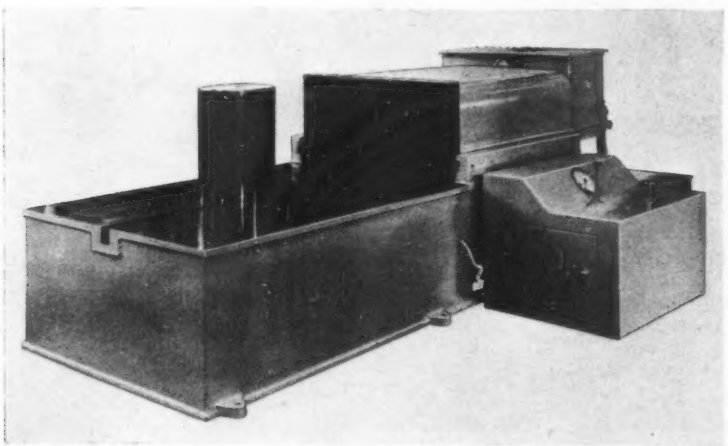
New Production Equipment

Hugh Smith 250-ton Electro-hydraulic Horizontal Press

Hugh Smith & Co. (Possil), Ltd., Glasgow, have built a 250-ton electro-hydraulic horizontal press, as shown in the figure, for the Harland Engineering Co., Ltd., Alloa, Scotland, for use on general fabrication work. It has a moving cross-head, which is independently guided, because it has been found that with high hydraulic pressures, and the relatively small ram sizes necessary, there is an increased danger of damage due to offset loading. The box-section fabricated cross-head is therefore provided with long cast-iron guideways, so that the ram is not subjected to any side loading. In addition, the cross-head has a front guide which moves in a longitudinal T-slot in the table.

With a hydraulic pressure of 4,500 lb. per sq. in., the total pressure exerted by the cross-head is 250 tons. The stroke is 18 in., and the maximum distance from the front of the cross-head to the centre of the post is 4 ft. The press is particularly intended for such operations as bending, forming, and straightening, and work can readily be loaded on the table by overhead crane. For forming small diameters, a removable pin can be fitted, and, if required, a heavy steel table can be mounted over the pin and tenoned into the main table T-slot. Both the main and return rams are enclosed to exclude dirt. The cross-head can be removed readily, to afford access to the rams.

This press is self-contained, the oil pressure supply being provided by Towler Brothers Electraulic pump equipment, with a 25-h.p. driving motor. The cross-head has an approach speed of 2½ in. per sec., a pressing speed of 0·3 in. per sec., and a return speed of 3 in. per sec. The approximate weight of the press, complete with the hydraulic pump equipment, is 12 tons.



Hugh Smith 250-ton Electro-hydraulic Horizontal Press

Hi-Ton 24-in., 8-station Indexing Table

The 8-station, electro-mechanical, indexing table, shown in the accompanying figure, has been introduced by Hi-Ton Machine Tools, Ltd., Sheepcote Street, Birmingham. This unit, which is seen with the top plate removed in order that the working parts may be observed, weighs 2¾ cwt. and has an overall diameter of 24 in. and a height of 27 in.

Indexing is effected by a modified Geneva mechanism driven by an f.h.p. motor through a reduction unit and a magnetic clutch/brake assembly. The driving roller at *A* engages in turn with each slot in the Geneva plate to provide an indexing movement of 45 deg. Positive location at each position is provided by a hardened steel plunger at *B*, which engages with bushed holes in the plate.

An external limit

View of Hi-Ton, 24-in., 8-station Indexing Table, with Top Plate Removed to Show the Indexing Mechanism

switch, connected to a suitable part of the machine tool with which the indexing table is employed, serves to energize the clutch in the unit, and de-energize the brake, whereupon the locating plunger is withdrawn from the indexing plate, and the driving member is rotated by the continuously-running motor.

After the driving disc has made a complete revolution, the microswitch *E*, connected in the circuit to the clutch and brake, is tripped, causing the former to be disengaged and the latter applied. The driving motor is connected to the mains, but the circuit for the clutch/brake assembly is operated on low-voltage D.C. supplied by a transformer and rectifier. Tooling weighing up to 20 lb. can be mounted on the table, at each station, and an ejection shoe can be fitted to a machined face on the housing of the unit.

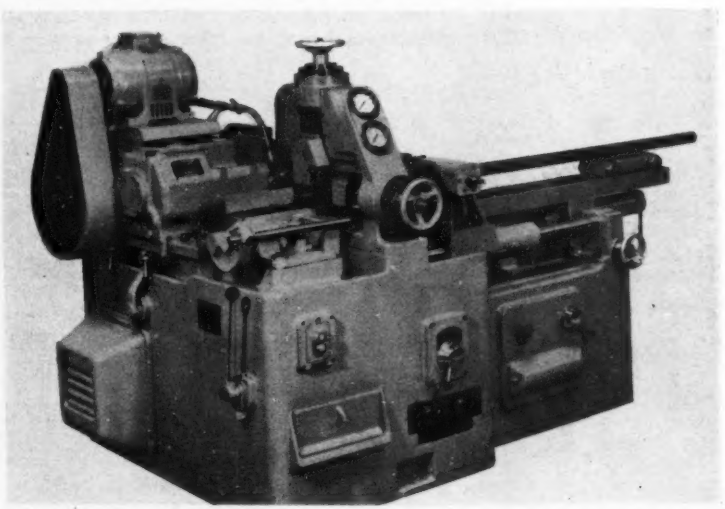
This indexing table can be fitted to drilling machines, presses, and special purpose machines on which components are formed, pressed, drilled, riveted, or assembled, for example, and can be arranged for intermittent or continuous operation.

Russell Hydrofeed 12½-in. Automatic Cold Sawing Machine

The 12½-in. automatic, hydraulic cold sawing machine, here shown, has recently been added to the Hydrofeed range built by S. Russell & Sons, Ltd., Bath Lane, Leicester.

It has a capacity for cutting bars up to 3½-in. diameter and 3¼- by 3¼-in. cross-section, and is intended for use primarily with saw blades of the inserted segment type, although for certain work, thinner, solid-type blades may be employed. The standard blade is 12½-in. diameter by $\frac{5}{32}$ in. wide.

The saw spindle is driven from a 3-h.p. motor through V-belts, and gears which run in an oil bath, and three peripheral saw speeds, namely 25, 40 and 70 ft. per min. are obtainable. Alternatively, a 2-speed driving motor can be fitted, and the six saw speeds then available range from 25 to 140 ft. per min. All shafts in the drive system for the saw head run in anti-friction bearings which are automatically lubricated.



Russell Hydrofeed 12½-in. Automatic Cold Sawing Machine

Of robust construction, and incorporating a narrow guide arrangement, the saw head slides on wide bedways, which are protected by covers. The hydraulic unit is driven by a 1½-h.p. motor, and the steplessly-variable cutting feeds available range from 0 to 20 in. per min. With the patented balanced feed system employed, the blade is prevented from being drawn into the work by the cutting action, equal tooth loading is obtained, and the feed rate is virtually unaffected by temperature.

An automatic bar feed unit is provided which has a roller-mounted carriage for supporting bar stock up to 12 ft. long. If required, however, provision can be made for handling longer bars. A scale and pointer are fitted to facilitate setting the working stroke of the feed unit for producing cut-off pieces up to 15 in. long. Provision can be made for a longer feed movement, if necessary, and a counter can be fitted. The cycle of operations is hydraulically controlled, and the correct automatic sequence of movements is ensured. During the cut, the bar is gripped by interlocking horizontal and vertical vices, which are of patented design. These vices enable several bars to be gripped simultaneously for cutting, without the need for packing pieces, and an attachment enables the material to be held firmly on both sides of the cut, to reduce the risk of damage to the saw-blade, and permit burr-free cutting. Coolant is delivered by a pump driven by a f.h.p. motor.

Weighing 1 ton 15 cwt., the machine occupies a floor space of 7 ft. by 4 ft. 3 in. The machine can also be supplied for semi-automatic operation, the bar feed motion then being effected by means of a handwheel, and the clamping and cutting cycle controlled by a single lever.

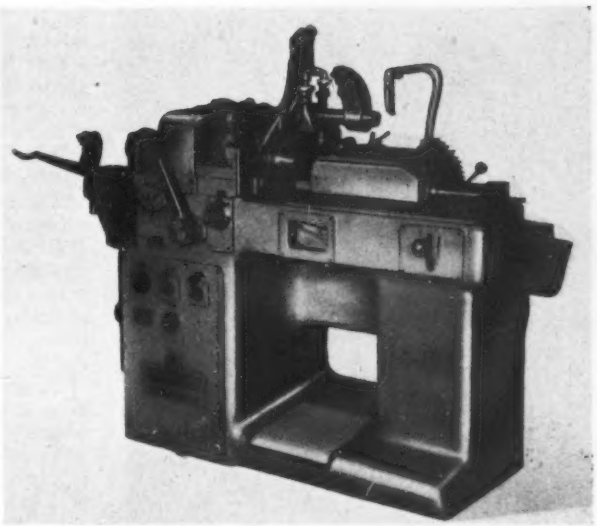


Fig. 1. Tönshoff Pantocop Precision Turret Lathe

Tönshoff Pantocop Precision Turret Lathe

In Fig. 1 is shown the latest Pantocop precision turret lathe built by the German firm of Tönshoff, for whom the sole agents in this country are Embassy Machine & Tool Co., Ltd., 248 Watford Way, Hendon, London, N.W.4.

As will be seen from the close-up view, Fig. 2, guideways at the front of the bed carry a longitudinal slide with an indexing turret for end working tools. Mounted on separate bedways at the rear, is a second slide, which incorporates an indexing turret to take tools for turning, boring, and parting off, for example. If required, a rear cross slide with power feed for facing operations can be provided. With this arrangement, sufficient cutting tools can be accommodated to enable intricate parts to be produced at a single setting, and since both turret slides may be brought into use simultaneously for performing different operations, the cycle time is considerably reduced.

Movement of the turret slides is obtained by separate levers, which are so positioned that they can be conveniently held in the operator's right and left hands during the entire working cycle. Engagement of power feeds to the turret slides is effected by means of electro-magnetic clutches, operated by push-buttons incorporated in the hand grips of the control levers. Another useful feature of the lathe is that provision is made for copy turning with the rear turret slide, a stylus member being automatically brought into engagement with a template of the part to be produced, when the corresponding turret tool is indexed to the working position. An overhead thread chasing attachment, of the leader and nut type, is fitted, whereby both internal and external threads may be cut.

The lathe is available in two sizes, designated type RPU42 and type RPU60, which have capacities for bar stock up to 1⅞ or 2⅜ in. diameter. A weight-operated bar feed unit or a motor-driven automatic bar feed and collet operating mechanism can be provided. The

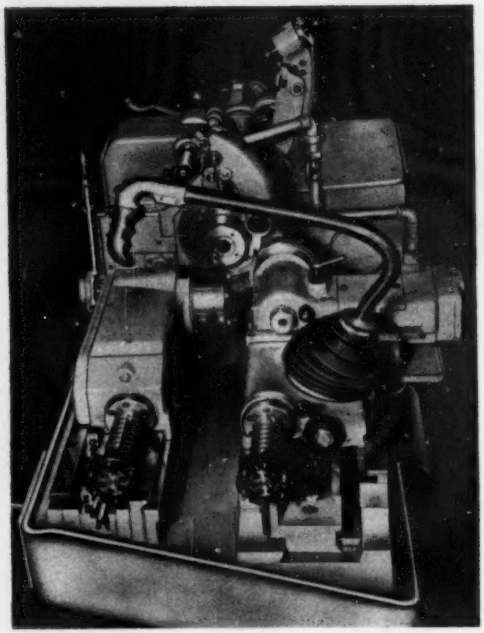


Fig. 2. Close-up View of the Turret Slides on the Lathe Shown in Fig. 1

latter equipment can be set, by means of a selector switch, so that the collet can be opened and closed by a lever when parts are to be held for second operation work. A maximum bar feed of 3⅞ in. is obtainable. If required, an air-operated chuck can be supplied.

A 2- or 3-speed motor may be fitted, and a vibration-free drive is transmitted by V-belt and 3-step pulleys to a reversing gearbox, and thence to the spindle by multiple V-belts.

Hare DYS Hydraulic Power Unit

The DYS general-purpose hydraulic power unit, here illustrated, is produced and distributed by P. J. Hare, Ltd., Wrington, near Bristol. This unit comprises a Hare EL high-pressure multi-plunger pump (driven by a 2-h.p. squirrel cage motor), oil tank and filter, control valve, adjustable pressure valve, pre-set safety valve, pressure gauge, motor starter, and push-button controls.

Of cast aluminium, the oil reservoir has a capacity of 4 gallons and houses the whole of the hydraulic system, so that external piping is avoided, apart from a capillary connection to the pressure gauge. The tank is supported above the bedplate on two brackets leaving an intermediate space which is enclosed by louvred side panels and accommodates the driving motor and starter. Drive to the pump is by duplex V-ropes, and provision is made for changing the speed.

A standard 4-way, open-centre, spool-type valve, suitable for controlling a single-acting or double-acting ram, is mounted in the oil tank, and is actuated by an arm on a cross shaft which projects through both sides of the casting. This extended cross shaft may be fitted, for example, with a lever, pedal linkage, air cylinder or solenoid, to provide the required movement. There are connections on the side of the reservoir for coupling the unit to the working cylinder.

At the end of the tank remote from the pump drive is fitted a cast aluminium instrument panel, which carries the push-buttons for the motor, the pressure gauge, and the knob of the pressure regulating valve. With an E.L. pump an output of 1 gal. per min. is provided at pressures up to 4,000 lb. per sq. in., or 1·6 gal. per min. at 3,000 lb. per sq. in. Other types of pump can be fitted for low and medium pressure applications. The unit may be used to supply hydraulic power for small presses, jacks, riveting and bending machines, and other applications. The overall dimensions are 28 in. by 13½ in. by 29 in. high.

Hare DYS Hydraulic Power Unit, for Pressures up to 4,000 lb. per sq. in.

Taylor Small Internal Belt Polishing Machine

Taylor Tools & Supplies, Ltd., Broadheath, Altrincham, Cheshire, have recently developed a small machine, to facilitate finishing inside contours, removing flash marks, and polishing small radii and contoured surfaces of all types. It is particularly intended for operations on small parts in die casting and plastics moulding shops.

The machine can be used vertically, as shown in Fig. 1, where the abrasive belt is operating in a restricted space in a handwheel casting. Such spaces, it may be noted, may be as small as 1 in. by 1 in. In Fig. 2, the machine is mounted horizontally on a bench and a small radius on a spanner is being polished with the aid of a rubber contact wheel.

Two idler pulleys can be fitted if required, and the arm is adjustable in various directions so that the angle of the belt can be arranged to suit the work. The smallest contact wheel is 1 in. diameter by 1 in. wide, and the largest, 2 in. diameter by 2 in. wide, and abrasive belts from ¼ to 2 in. wide by 60 in. long can be employed. The head can readily be removed, to facilitate changing the contact wheels.

Fig. 1. The Taylor Small Internal Belt Polishing Machine is here being Employed in the Vertical Position for Finishing Hand-wheel Spokes

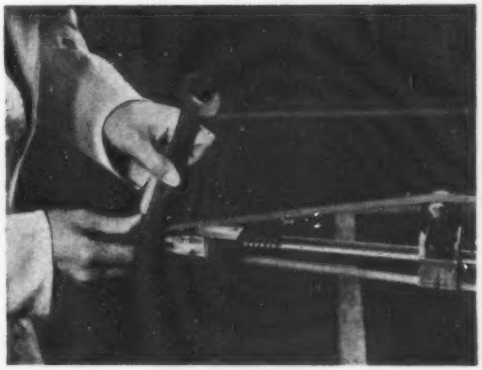


Fig. 2. For this Operation, the Small Internal Belt Polishing Machine is Mounted Horizontally on a Bench. A Rubber Contact Wheel is Used

Drive is taken from a 1-h.p. totally-enclosed, fan-cooled motor, and the belt speed is 4,000 ft. per min. Guards can be supplied, and the equipment includes a push-button, direct-on starter.

Dean, Smith & Grace 21-in. Swing Lathe with Hydraulic Copying Attachment

Fig. 1 shows a 21-in. swing lathe fitted with a hydraulic copying attachment, as recently built by Dean, Smith & Grace, Ltd., Keighley, Yorks, and Fig. 2 is a close-up view of the attachment from the rear of the machine. The front tool slide is available for normal turning and screwcutting operations, and the lathe illustrated admits 60 in. between centres.

This copying attachment is mounted on an independent bottom slide, which is adjustably connected to the standard front slide, so that adjustments for successive roughing cuts can be made by means of the normal saddle handwheel and micrometer dial. When the correct size has been obtained for the first component of a batch, the setting remains undisturbed until the tool requires regrinding. The attachment is particularly intended for turning shafts.

For copy-turning, the lathe spindle rotates in the normal forward direction, and the inverted copying tool has micrometer longitudinal adjustment for positioning in relation to the work and master. A separate micrometer adjustment is available for setting the tool for work diameter. The attachment is suitable for external or internal longi-

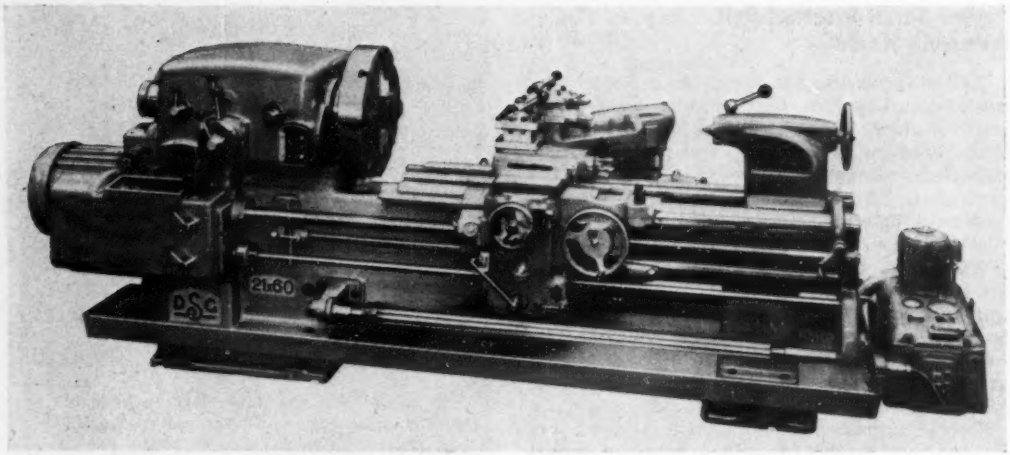


Fig. 1. Dean, Smith & Grace 21-in. Swing Lathe, with Hydraulic Copying Attachment

tudinal copying from a turned master or flat template, and can also be employed for transverse copying from a flat template.

Brackets on a support beam carry the flat template or the turned master, and an adjustable tie rod between the two brackets enables the master and centres to be moved as one unit to facilitate positioning the master relative to the workpiece. If heavy facing operations are to be carried out, the bulk of the metal should be removed by a tool in the front holder. The copying tool is then brought into position and the normal cross-feed engaged, the tool being traversed from the centre of the workpiece and away from the operator. Adjustments for subsequent cuts are made by means of the side-adjustment handle.

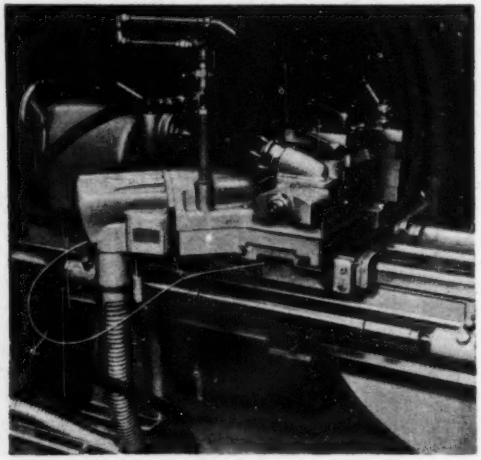


Fig. 2. Rear View of the D.S. & G. Lathe, Showing the Hydraulic Copying Attachment

For transverse internal copying, the tool is not inverted and is mounted in an extension holder. The cut is started at the outer edge of the workpiece at the front. When copy boring, the tool is positioned forward of the centre line, as for internal copy-facing.

On the lathe shown, the maximum swing over the saddle for copy-turning is 12½ in., and the maximum diameter and length of the cylindrical master are 7 and 66 in. The maximum difference in diameters of a copy-turned workpiece is 6½ in., and the maximum rate of copying slide traverse is 25 in. per min. at 45 deg. A hydraulic pump unit, with built-in electrical equipment, is provided, as seen at the end of the bed in Fig. 1. Hydraulic copying attachments are also being fitted to the firm's 13- and 17-in. swing lathes.

Bates & Bates "Rack-type" Multiple Spot Welding Machine

The "rack-type" multiple spot welder, here shown, has been introduced by Bates & Bates, Ltd., Blackburn Road, Liverpool, 19, and is being exhibited at the Brussels World Fair.

It incorporates two 45-kVA. water-cooled transformers, which enable a maximum of eight spot welds to be made simultaneously or successively,

and the upper electrodes can be set in a variety of positions to give different patterns. For coarse adjustment of the welding current, there is a 5-position switch, and fine settings are made electronically by phase-shifted ignitrons.

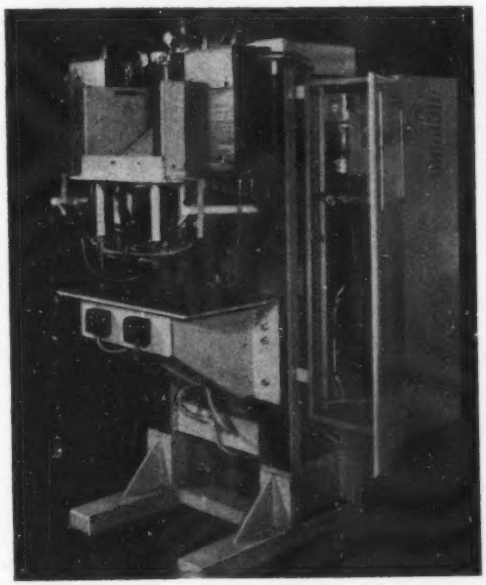
The electrodes are operated by 2-in. stroke single-acting hydraulic cylinders which have a piston area of ½ sq. in. Since the external diameter of these cylinders is only 1⅞ in., the electrodes can be set close together if desired. A gauge is fitted to indicate the electrode force, which can be varied from 150 to 800 lb. If required, hydraulic cylinders of larger diameter can be fitted to give higher electrode forces for projection welding and electro-forging operations. Fluid is supplied to the cylinders from the company's type B hydraulic intensifier, which is intended for operation by compressed air at 80 lb. per sq. in pressure, and will deliver 17 cu. in. of fluid per min. at a pressure of 1,600 lb. per sq. in.

A 30- by 18-in. work-table may be provided, as shown, which can be adjusted for height in 2-in. steps. Alternatively, a triangular table with 20- by 18-in. working surfaces can be fitted which has screw adjustment for height, and can be indexed about a horizontal axis so that different fixtures can be brought to the working position. The electrodes may then quickly be set for position with the aid of templates, for producing various patterns of spot welds on different workpieces. Three sets of controls are provided, which enable different welding currents, also welding, forging, and "off" periods, to be pre-set to meet the requirements of various workpieces.

These settings are automatically selected, simultaneously with the indexing of the work table, by means of switches, when the set-up is being changed.

If required, a belt-type conveyor can be supplied, which enables components to be assembled on plate-type fixtures at one side of the machine, then transferred to the central position for welding, and finally moved to the opposite side for automatic unloading. Alternatively, the conveyor may extend from front to back of the welded steel frame, which is of "open" construction.

Two or more machines may be installed side by side, and when they are fitted with tables of the type illustrated, a continuous working surface is provided. Alternatively, one welder can be mounted at the rear of another, with a conveyor extending between them.



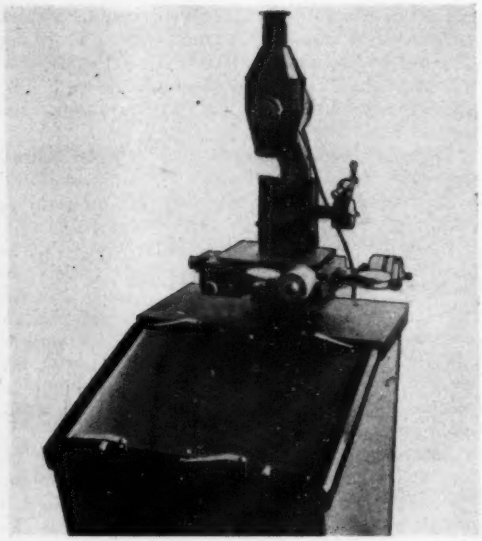
Bates & Bates "Rack-type" Multiple Spot Welding Machine

Shadomaster VMP Measuring Projector

Shown in the figure is the Shadomaster VMP measuring projector made by Watson Manasty & Co., Ltd., 139 Richmond Road, Kingston-on-Thames. It has been developed from the firm's CRP Mk. 11 optical projector and has a 15- by 12-in. screen. Magnification from 10× to 100× can be obtained. The workpiece stage measures 7 by 5⅜ in., and there is a 4¼- by 3¼-in. glass insert upon which parts may be laid flat for projection.

A cross travel of 1 in., and a longitudinal travel of 2 in. are provided for the stage, measurements being made with the aid of large-barrel micrometers reading to 0·0001 in., or 0·002 mm. if required, in conjunction with dial indicators. The squareness of the stage slideways, it may be noted, is stated to be within 5 sec. of arc. Centres with a capacity for workpieces up to 4 in. diameter by 6 in. long are available, and special fixtures can be supplied to meet customers' requirements. The vertical adjustment of the stage is 2⅜ in.

The lamphouse can be pivoted to the right and left to suit the helix angles of screw threads and worms, and is positively located in the vertical position. A built-in transformer, with double-pole switch, operates from 200/240-volt A.C. mains supply. Standard Shadoform charts for Whitworth, B.A., Unified, and Metric threads are available, and special charts can be supplied. Other equipment includes the Shadomaster No. 5 grati-



Shadomaster V.M.P. Optical Measuring Projector

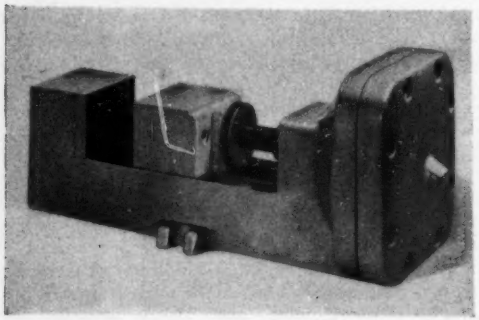
cule which can be used for setting and checking purposes.

Buck & Hickman Ltd., Otterspool Way, Watford-by-Pass, Watford, Herts, are selling agents for Watson Manasty projectors.

Dyson & Nelson Air-operated Vice

Dyson & Nelson, Viaduct Street, Huddersfield, have recently introduced the air-operated vice shown in the figure.

A maximum opening of 3 in. can be obtained between the 3½-in. wide jaws, and variable clamping loads up to 2,200 lb. may be applied to the work. The moving jaw has a power traverse of ½ in. and is adjusted by a large-diameter screw and nut to suit the thickness of the workpiece to be held. A foot-operated valve can be supplied for controlling the air supply. Detachable hardened steel jaw plates are provided, and special jaw pieces for holding particular components can readily be fitted, if required.

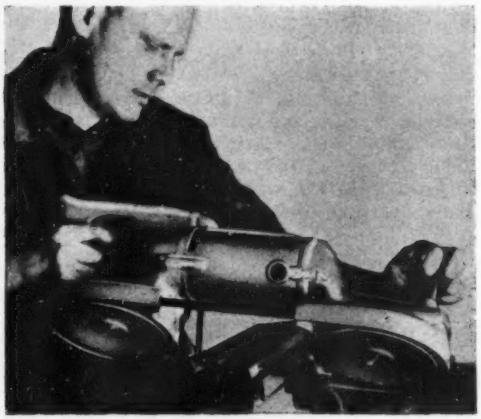


Dyson & Nelson Air-operated Vice

Forte Portable Bandsaw

Shown in the figure is the German-made Forte portable bandsaw, for which Verrolec, Ltd., Balfour House, Finsbury Pavement, London, E.C.2, are the distributors in this country.

Weighing approximately 22 lb., this bandsaw has a capacity for cutting solid bars up to 2¾ in. diameter and of 3- by 3-in. cross-section, and extruded sections up to 4¾ by 3 in. It will take a 28-in. long by ½-in. wide saw blade, which is carried by contact wheels fitted with rubber facings, and passes between two guide plates. The speed of the saw is 115 ft. per min., and it is driven through gearing from a universal motor housed in the light-alloy body. Controlled by a trigger-type switch incorporated in the pistol-grip handle, the motor has a power consumption of 200 watts, and is designed for operation from a 220-volt supply. Measuring 22 by 7¼ by 7 in., the tool may be used, for example, for sawing operations in confined spaces, removing runners and risers from castings, and cutting bars which are held in a vice.



Forte Portable Bandsaw

The Production of Precision Studs for Severe Duties

By WALTER HAMBRECHT*

For use in connection with conventional and nuclear power generating installations and for similar applications, special studs of high strength, and sometimes of very large size, are required. In particular it may be necessary to maintain good surface finish to ensure the necessary fatigue resistance.

Early last year, the Standard Pressed Steel Co., Jenkintown, Pa., U.S.A., organized a separate Stud Division to manufacture these fasteners. Products of the division, so far, included precision studs up to 6 in. diameter and 72 in. long, often of special forms, with end or cross-drilled holes and other features. Testing apparatus, toolmaking equipments, and inspection devices were provided, and the initial expenditure on machine tools for the Division was 500,000 dollars.

Experience in the manufacture of high-strength, fatigue-resistant fasteners for the aircraft and machinery industries had indicated the value of rolled threads. On request, the Reed Rolled Thread Die Co., Worcester, Mass., built the special machine shown in Fig. 1, for rolling threads up to 4 in. diameter.

Another problem was presented by the intricate shapes specified for many studs used in modern power-plant equipment. One reliable machine tool for producing close-tolerance parts of complicated form is the copying lathe, and for this work, the Lodge & Shipley Co., Cincinnati, Ohio, built a tracer-controlled lathe that will accommodate diameters up to 11¾ in. and lengths up to 102 in. The machine will hold outside diameters to 0·001 in. tolerance, and concentricity, to ±0·0001 in. per inch of length.

Quality is controlled at all stages. Incoming material up to 1½ in. diameter is examined by magnetic analysis, and for larger diameters, analysis is carried out in the chemical laboratory of the metallurgical department. Throughout the production stages, studs are carefully inspected, and finished studs are checked for yield strength, ultimate strength, fatigue strength, Rockwell hardness, and surface finish.

To meet a customer's requirements, material with the correct physical properties must be chosen. Next, the effects of various alternative methods of fabrication must be evaluated before the final design is determined. Cold-working, hot-working, machining, control of the metallic grain formation, and many other factors affect the strength and endurance of the finished studs. Choice of the correct machining sequence is also important. The execution of a recent order for

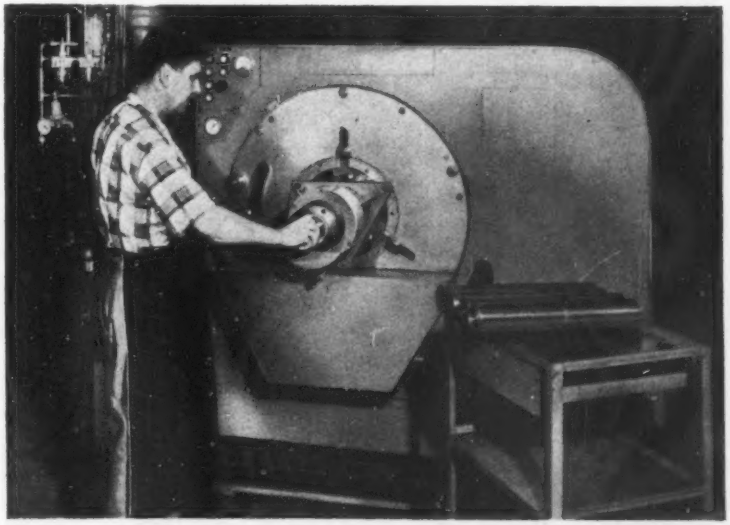


Fig. 1. Threads on Precision Studs up to 4 in. Diameter are Cold-formed on this Reed Thread-rolling Machine

*Precision Stud Division, Standard Pressed Steel Co., U.S.A.

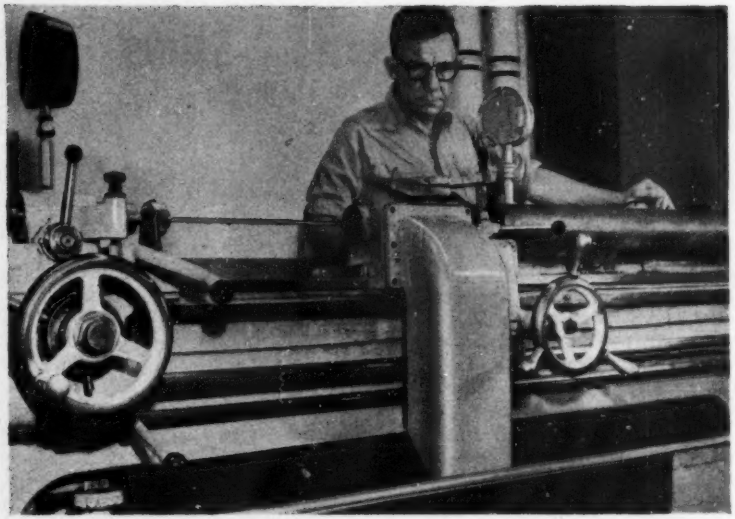


Fig. 2. Holes for Heating Elements are Drilled Through Special Studs on this Deep-hole Machine

46 large studs for a commercial nuclear reactor, which is being built by Foster Wheeler Corporation for Westinghouse Electric Corporation, affords a good indication of the general procedure.

Each of the 5-in. diameter studs weighs nearly 300 lb. and is 60 in. long. Produced from bar stock of 5½ in. diameter, the studs were cut roughly to length on a DoALL band saw, which can cut at the rate of 6½ sq. in. per min. The material, which was AISI 4340 stainless steel containing carbon 0·38 to 0·43, nickel 1·8, chromium 0·8, and molybdenum 0·25 per cent, was supplied by the customer. After chemical analysis of the incoming work-material, a certificate was issued to the customer that the material conformed to the specification.

A Pratt & Whitney deep-hole machine, as shown in Fig. 2, was then used to drill precision holes through the 60-in. long studs. Holes up to 1⅝ in. diameter can be drilled on this machine. The maximum drilling speed employed is 200 surface ft. per min. with a feed rate of 0·001 in. per rev. Tolerance on diameter can be held to 0.001 in., and on run-out, to 0·0001 in. per inch of length. These holes are drilled to permit insertion of electric-heater elements which are employed when installing the studs. Tightened while hot, the studs contract during cooling, and they can be re-heated in the same manner to permit easy removal for plant maintenance or inspection.

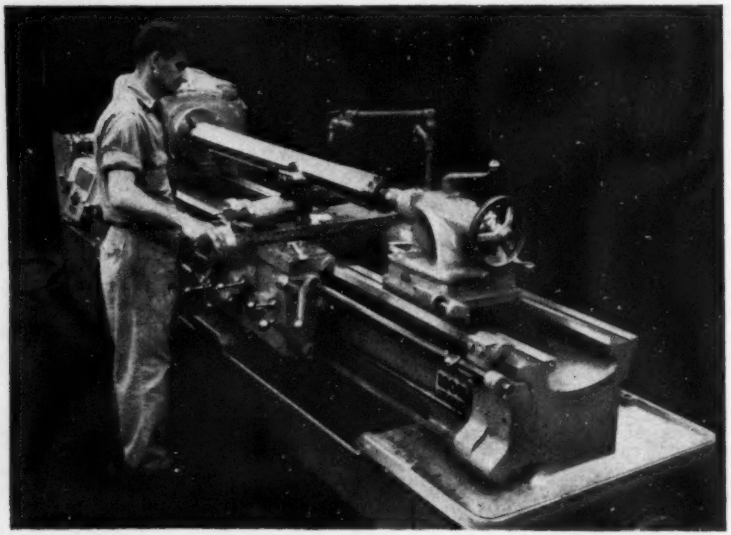


Fig. 3. Set-up for Turning a 60-in. Long Stud, for an Atomic Reactor, on the Shank and the Surfaces to be Threaded. A Surface Finish of 64 micro-inches is Obtained

The 5½-in. diameter stock was machined to 4·990 in. $+0 -0{\cdot}010$ in. for the thread diameters, and to 4·738 in. $\pm 0{\cdot}010$ in. for the shank diameter on the Monarch

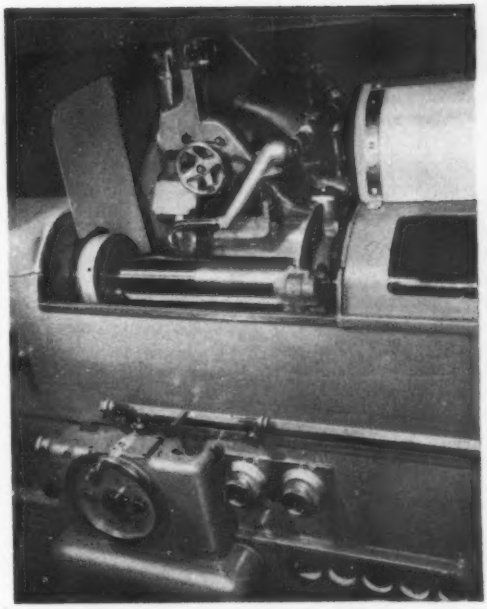


Fig. 4. Threads on Special 5-in. Diameter Studs were Ground on this Matrix Machine. A Redesigned Tailstock Enables Work up to 65 in. Long to be Accommodated

lathe seen in Fig. 3, which has a capacity for workpieces up to 16 in. diameter and 78 in. long. A carbide tool was used to turn the studs at 400 surface ft. per min. and 0·2 in. of stock was removed at each cut, with a feed of 0·008 in. per rev., and a surface finish of 65 micro-inches was obtained. Between operations, the large studs were handled by means of a special gripper with padded jaws, to prevent damage to the finished surfaces.

Threads on the 5-in. diameter studs for the atomic reactor were ground on the Matrix machine shown in Fig. 4. Grinding is employed for all threads larger than 4 in., or when the total run-out must not exceed 0·001 in. A special tailstock was designed and built for this machine to enable workpieces up to 65 in. long to be handled. The former limit was 48 in. Threads are ground with a multi-ribbed aluminium-oxide wheel on which the thread profile is formed by means of a diamond dressing tool.

In some other instances, wheels for thread grinding are dressed by crushing. The traverse rate on the Matrix machine is about 50 in. per min. In common with all large-diameter threads, those on the atomic-reactor studs were inspected with an optical comparator.

Inter Act Joining Material for Metals

Interectics, Inc., U.S.A., have recently introduced a material known as Inter Act which enables joints to be made between similar and dissimilar non-ferrous metals, for example copper, aluminium, magnesium, titanium, brass, zinc, silver, and gold. A permanent chemical bond is obtained by ion exchange, and it is claimed that the resulting joint is usually stronger than either of the metals involved, and frequently has greater corrosion resistance. For some types of joints, very important cost savings are said to be obtainable.

The material, which is the subject of patents, is described as a reaction eutectic, and when heated it eliminates surface oxide layers and causes the metals to be joined to flow together at a temperature lower than the melting point of either. One form, known as Inter Act-S, comprises chlorides of zinc, lithium, potassium, and sodium, enclosed in a tube made from an alloy of pure zinc and aluminium. Both the core and the sheathing, which has an outside diameter of ⅛ in., play a part in the joining process. This material is recommended for T-, butt, and other exposed joints.

Inter Act-E, of similar composition, is supplied in powder form, and is intended for joints with larger contact areas. A third product—Inter Act-G—is composed of aluminium trichloride, zinc chloride, and sodium chloride. Available in granular form, it is said to be suitable for joining foils and other materials, where large areas are involved and low temperatures must be employed.

Joints can be made manually by applying Inter Act " wire " while the work is heated with a torch, and once the required temperature has been reached the reaction is completed in about 2 sec. Alternatively, the work may be carried through a furnace on a conveyor, the wire being applied automatically by means of guns. With another method, wire rings or other pre-forms can be used, and provision can be made for heating the joint areas locally.

Distortion Reduced by Automatic Marquenching

When conventional quenching methods resulted in excessive stresses and consequent distortion of steel parts, a mass marquenching technique was introduced at the Fort Wayne, Ind., works of the International Harvester Co., U.S.A. This process of quenching in hot oil is being employed in conjunction with five continuous-type, gas-fired carburizing furnaces, and exceptional results as regards both economy of operation and freedom from rejects are being obtained.

With the former gas-carburizing procedure, transmission and differential gears and king-pins were quenched directly in a "cold" oil bath (100 to 120 deg. F.). Distortion and warping were then excessive, and with some shafts run-out ranged from 0·002 to 0·020 in. These shafts could be salvaged by straightening, but the cost was considerable and the operation set up stresses.

Marquenching (hot-oil quenching) enables distortion in gears, pinions, and shafts to be kept to a minimum, by avoiding the high stresses which may be caused by conventional quenching methods, whereby parts are hardened from the outside inwards. Marquenching differs in that the core is hardened first, so that it can contract and expand without any restriction due to a hardened case. After the part has been removed from the quenching bath, the surface layer is hardened. This double process is most effective for the heat-treatment of parts which will be heavily loaded in service.

In marquenching, the workpieces are first immersed in oil maintained at a temperature (300 to 400 deg. F.), equal to or slightly above the initial transformation value at which martensite begins to form in the carburized case. The work is held in the bath just long enough to achieve the best temperature equalization and to allow transformation of the core to martensite. Transformation of the case to martensite occurs when the work is removed from the bath and allowed to cool in air.

Parts heat-treated in this manner are straighter and more durable, and the service lives of shafts and gears have been increased by as much as 200 per cent in some instances. Marquenching also eliminates the need for quenching dies, plugs for splined bores, and excessive manual handling during heat-treatment.

These results were achieved with automatically operated, batch-loaded, furnaces and a special-purpose quenching oil. The five furnaces are 2-row carburizing units, and each has 21 pushers per row and a gross weight capacity of 1,000 lb. per hour. A general view of one of the five furnaces is given in Fig. 1. The furnaces, which are operated on different cycles to produce various

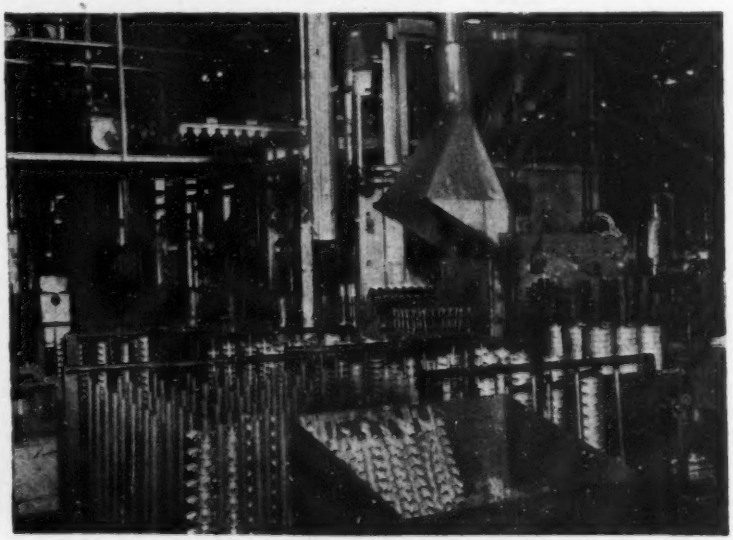


Fig. 1. A General View of a Continuous-type, Gas-fired Carburizing Furnace for Casehardening Transmission and Differential Gears

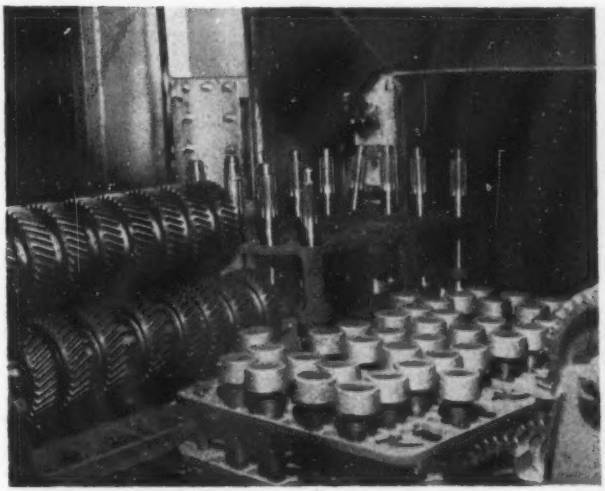


Fig. 2. Special Cast Alloy Fixtures have been Designed to Suit Parts of Different Shapes in Order to Avoid Distortion and Permit Thorough Quenching

case depths, are heated by radiant tubes, and have 4-zone temperature control. Temperature in the first three zones is 1,700 deg. F., and the fourth, 1,650 deg. F.

In the first three zones of the furnace there is an atmosphere of generated endothermic gas with a dew point of 0 to 10 deg. F. Natural gas is mixed with the generated gas in the ratio of 37 to 425 cu. ft. per hour. In the last section of the furnace, 700 cu. ft. of generated endothermic gas is used per hour. This gas has a dew point of 25 to 30 deg. F., and no natural gas is added to the atmosphere. The purpose of the atmosphere is to produce a very rich case, and time is allowed for diffusion to bring the carbon content to 0·85 to 0·90 per cent. In this way, parts with maximum hardness are obtained.

Work to be heat-treated is loaded into special cast alloy fixtures, as seen in Fig. 2, which serves to reduce distortion. The design of the fixture is dependent upon the shape of the part. For example, pinions are located vertically, whereas larger gears are loaded horizontally in order that they shall be less subject to heat distortion in the furnace. Each part has been carefully studied to determine the best form of fixture that will help to preserve straightness during the heating period, and that will not interfere with effective quenching.

Loaded racks of parts are seen in Fig. 3 ready to be pushed into the furnace. The heat-treating cycle is such that the parts are maintained at 1,700 deg. F., for sufficient time to produce the required case depth. For a 0·040-in. case depth, the work remains in the furnace for seven hours. Such a cycle is suitable for practically all grades of steel used—SAE 4817, 8622, 8627, and 4118. All parts are hardened to a minimum of 57 Rockwell C. Four different case depths are produced, the shallowest being 0·031 in., and the deepest, for differential drive pinions, 0·080 in.

Fig. 3. Fixtures Loaded with Shafts and Gears are here seen Ready to be Pushed into the Atmosphere-controlled Furnace, which is Held at a Temperature of 1,700 deg. F.

N

Fig. 4. Heat-treated Gears are Cleaned by Blasting with Steel Shot, on this Rotary-table Machine, and Finally are Inspected and Tested

As already indicated, the temperature is reduced to 1,650 deg. F., prior to quenching. The fixtures are pulled out of the furnace manually, by means of a hook, into a vestibule, from which air is excluded. Next, the parts are lowered into the quenching tank for a period of 6 to 10 min., the exact time depending on the cross-section. About 80 per cent of the work is subjected to a 6-min. quench, but parts having cross-sections thicker than 2¾ in. require a 10-min. period. At the conclusion of the quenching cycle, which is automatically timed, the work is returned into the hood. The outer door is then raised, and the parts are removed, and placed on a cooling rack for a period of four hours before they are washed. The principal reason for the cooling period after oil quenching is to permit transformation, since the case is quenched in air only.

The quench tank holds 1,200 gal. of Shell Oil Co. Voluta 972, at room temperature. When the temperature of the oil is raised to 400 deg. F., for marquenching, the volume increases to 1,400 gal. The tank has an overflow which allows the oil to drain to a small storage tank with a capacity of about 200 gal. This arrangement enables the unit to be filled when cold, and to form a seal for the atmosphere. When the oil is heated, the overflow of 200 gal. is returned to the reserve tank in readiness for the start of another week's operation.

The quenching oil is heated by six radiant tubes, three on each side, and the temperature is controlled by thermocouples located between the agitator and the quenching trays. In this way, the temperature of the oil which is being directed on to the work is measured.

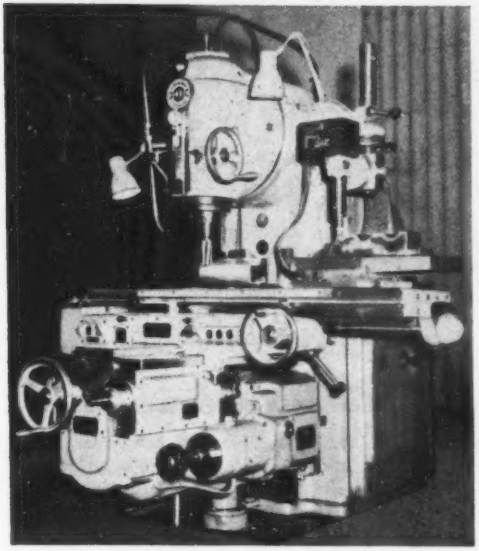
Agitation of the oil occurs only during quenching. Previously, without a protective atmosphere over the oil-quench tank, and constant agitation, the life of the oil was approximately 400 hours. When the system was changed to provide for agitation only during quenching, the oil life was increased to more than 1,000 hours. Now, with the provision of a protective atmosphere over the oil (the same atmosphere as in the furnace), its life has been raised to an average of 10,000 hours.

In one quench tank, the oil has been used for a total of 16,941 hours. When the oil was placed in this tank in November, 1954, it had a viscosity of 89·1, and in August, 1957, the viscosity was 107·8. In the performance evaluation tests on Shell Voluta 972, the oil lasted for 27 months before it became necessary to change it. During this period, covering 9,466 hours of quenching, 2,659,946 lb. of material were processed. Drag-out loss is very slight, amounting to about 400 gal. in a year's operating time (6,000 hours).

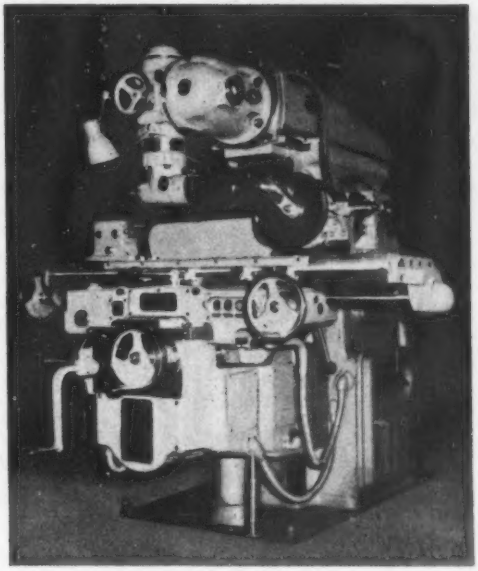
Heat-treated gears are cleaned by blasting with steel shot, as seen in Fig. 4. Completed parts are passed to inspection for a percentage check of hardness and verification of other specification requirements. Sample parts are tested by dynamometers, under maximum calculated stress load, for one million cycles, to determine life characteristics. Load-carrying capacity has been increased by 20 per cent, according to the dynamometer tests. From inspection, some parts go to the machining division where the bores are ground, and others are ready for immediate use.

Parts are also regularly submitted to the laboratory for sectioning, and the case depths are checked both by visual measuring and Tukon hardness tests. In addition, test pins are placed in the furnaces. These pins are reheated to 1,475 deg. F., quenched, broken, and etched with acid, to determine the case depths.

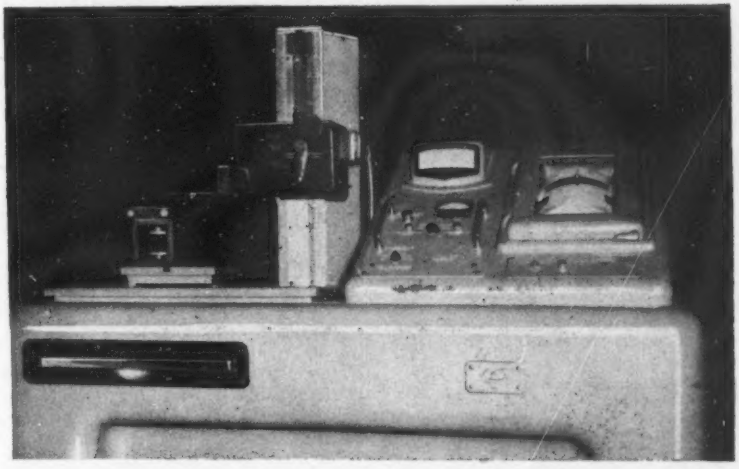
Some Russian Machine Tools Shown at the Leipzig Fair



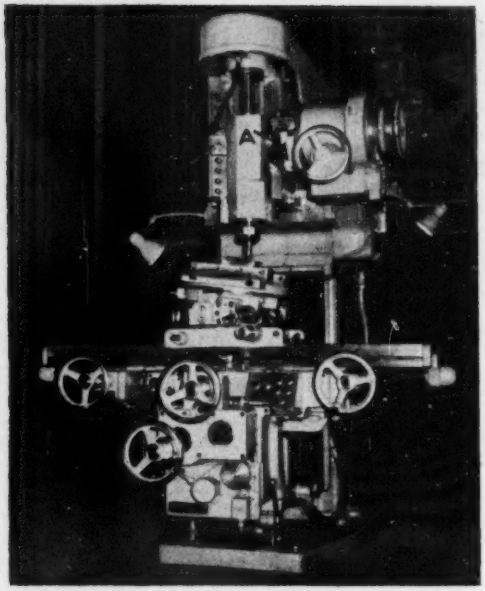
Heavy-duty knee-type milling machine with vertical swivelling spindle head, and electric copying attachment. The spindle speeds range from 40 to 2,000 r.p.m.



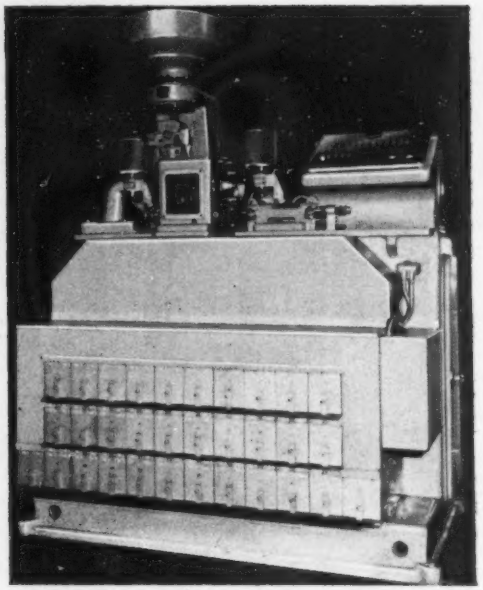
Knee-type milling machine equipped with a horizontal spindle in the column, and a universal spindle head on a traversing ram. Spindle speeds range from 30 to 1,500 r.p.m., and power feed and rapid traverse are provided in all directions for the knee. The table measures 50 by 12¼ in.



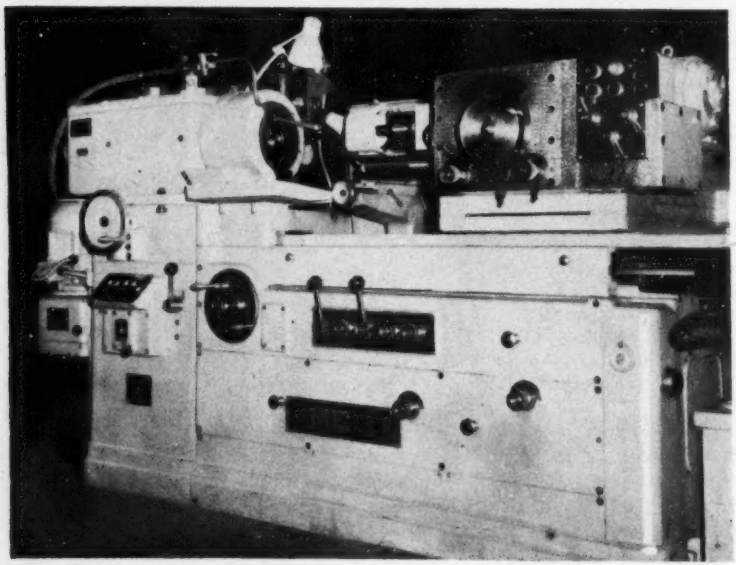
Surface-finish testing machine with power-traversed electronic stylus head, for production applications. The chart unit is seen on the right



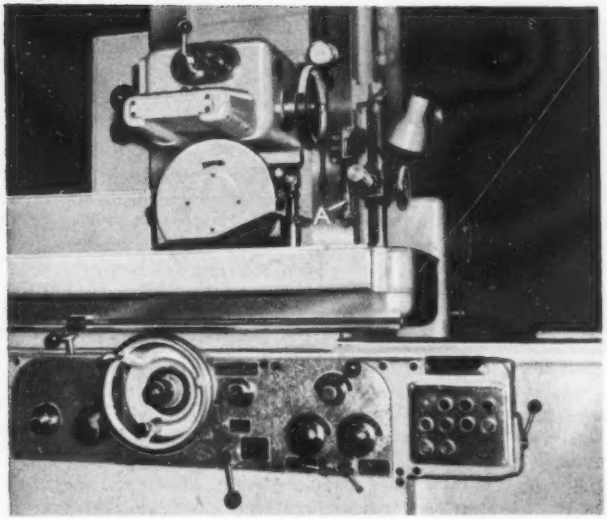
This 63- by 15¾-in. table, vertical, knee-type milling machine is fitted with a rise and fall spindle head for producing concave and convex contours. The spindle head motion is derived from an adjustable crank arrangement at *A*, while the table traverses longitudinally and is fed crosswise.



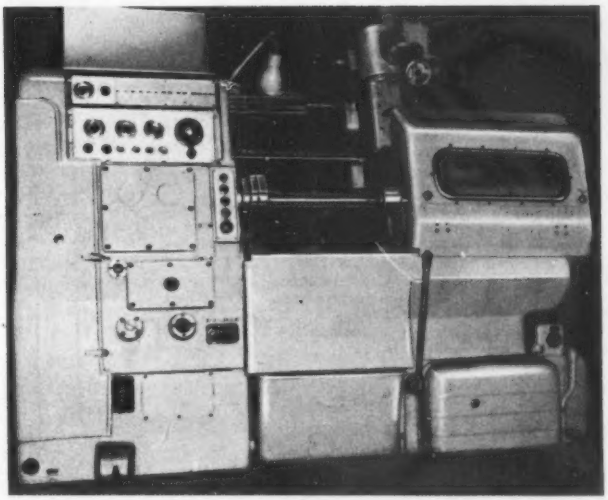
Automatic checking and grading machine for taper rollers from 10 to 20 mm. (0·4 to 0·8 in.) diameter. The rollers are loaded into an overhead hopper and are graded at the rate of 3,600 per hour. As the rollers are checked, the results of the inspection are shown on the panel on the right



Automatic internal grinder specially intended for operations on ball and roller races from 2⅜ to 7 in. diameter, and up to 4 in. long. Size is controlled by an electric gauge head fitted with a stylus which makes contact with the bore of the work. The work-head speeds range from 150 to 450 r.p.m. An internal grinder of virtually the same design was exhibited by the Chinese People's Republic



Surface grinder of 47- by 14- by 15¾-in. capacity, fitted with an electrically-operated sizing attachment at *A* on the wheel-head column. The automatic down-feed of the wheel-head is stopped by contact of the stylus of the attachment with the workpiece



Hydraulic copy-turning lathe for work-pieces up to 20 in. long. The copying slide moves on vertical bed-ways above the workpiece, and an indexing template holder enables a number of cuts to be taken during the automatic cycle. The spindle speed and rate of feed can also be changed during the cycle, and two lower, in-feed, tool-slides are provided

Some 15 Russian-built machine tools were shown at the Leipzig Fair as a token exhibit. They were noteworthy for good finish, and embodied all the features which are to be expected in up-to-date designs.

In addition to the machines shown on this, and the preceding pages, reference may be made to a vertical hydraulic surface broaching machine with magazine feed and automatic ejection for the workpieces, also a horizontal spline-shaft grinder, which admits 5 ft. between centres. It may be noted that a grinder of identical design was shown by the Chinese People's Republic.

Special-purpose machines incorporating unit heads for drilling and tapping, were also among the exhibits, together with centre lathes, and a 35-mm. (1⅜-in.) capacity radial drilling machine. Another machine of interest was a heavy-duty horizontal fine borer, suitable for general purpose use, which was equipped with a compound work table mounted on a vertically-adjustable knee at the end of the bed.

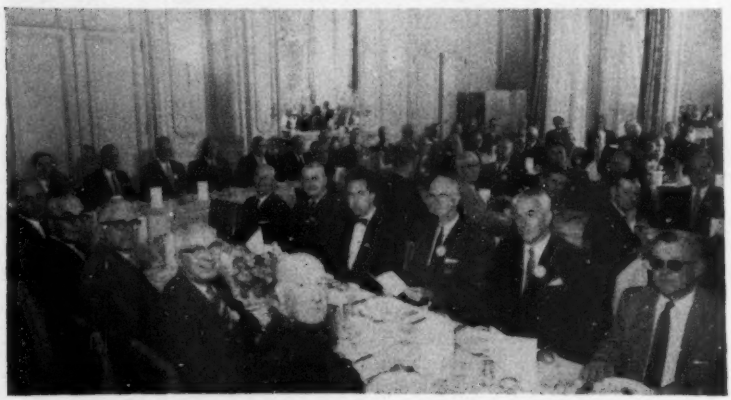
News of the Industry

Calder Valley

SANDHOLME IRON CO., LTD., Todmorden, are actively engaged in the production of a wide variety of equipment for power plants, collieries and colliery by-products plants, including equipment for iron ore sintering plants. The foundry is experiencing a well maintained demand for spheroidal-graphite, heat-resisting, and grey-iron castings. Our attention was drawn to recently-installed heat-treatment plant, comprising two Birlec 175-kW. batch-type furnaces for work up to 9 ft. long, complete with electric charger and control instrumentation, for annealing, stress relieving, hardening, and tempering processes, with oil bath and cooling arrangements. A 200-kVA. Birlec-Detroit rocking arc furnace has also been added, for melting special iron alloys of the S.G. and Ni-resist types, and stainless steel. Baths and clothes lockers have recently been provided for the employees, as well as a first-aid room.

❖ ❖ ❖

Some 40 senior executives of American business firms affiliated to the Greater Detroit Board of Commerce recently entertained the Officers and Council of The Gauge and Tool Makers' Association to lunch at Claridges Hotel, London. It may be recalled that members of the Board were the guests of the Association at a luncheon at the Savoy Hotel in 1950



A. KINGHORN & CO., LTD., Todmorden, are occupied with the production of guillotine shearing machines, ranging up to 10-ft. by ¼-in. capacity, and press brakes, up to 200 tons, for sheets up to 12 ft. wide, also lever shearing machines for ¼-in. thick plates. We may note recent export orders from South Africa and Canada.

ORMEROD SHAPERS, LTD., Hebden Bridge, are fully employed on home and export orders for pillar-type shaping machines, from 10- to 36-in. stroke, single- and double-head traversing-type shaping machines, from 16- to 32-in. stroke, and slotting machines, from 4- to 20-in. stroke. Export business is in hand for South Africa, Pakistan and Canada. Activity is also well sustained in the machine shop accessories and equipment section, and items in particular demand include surface plates, marking-out tables, steady rests, angle plates, and machine vices.

JOHN PICKLES & SON (ENGINEERS), LTD., Hebden Bridge, have a good order book for a wide range of woodworking machinery, and approximately 50 per cent of the output is being exported. In the works we noted a 60-in. horizontal log band mill with hydraulic feed, a 28-in. vertical mortising and boring machine for railway wagon and carriage works, saw sharpening and doctoring machines for band and circular saws, a batch of vertical spindle moulding machines, 30- and 36-in. bandsawing machines and roller-feed circular re-saws. A 10-ft. 6-in. rotary veneer peeling machine was recently despatched to Australia. Export markets include India, Iran, Sudan, South Africa, Southern Rhodesia, Australia and New Zealand. The latest addition to plant is a Woodhouse & Mitchell 8½-in. centre lathe. In the foundry our attention was drawn to recently-installed baths and clothes lockers.

P. CROSSLEY, LTD., Mytholmroyd, report a continued demand for turned hexagon-head

bolts and screws, in sizes from 2 B.A. up to ⅝-in. diameter by 2½ in. long, which are being supplied with all types of threads and are destined for a variety of industries.

D. E. STUTTARD, LTD., Westfield Mill, Mytholmroyd, owing to the volume of orders for the patent American-design oil-burning equipment, for both domestic and industrial heating, which they manufacture under licence, have acquired a former cotton mill at Colden, near Hebden Bridge, to enable production to be increased. Some 44,000 sq. ft. of floor space will thus be made available, and additional machinery has been ordered for this factory, where, it is expected, production will begin in August.

SAGAR-RICHARDS, LTD., Luddendenfoot, continue to experience a good demand for die-cast aluminium-bronze gear selector forks and synchromesh gears from the motor car, motor-vehicle, and tractor industries. Other activities include the production of aluminium and zinc-alloy die-castings, which are being supplied in bush form, fully machined, in sizes up to 12 in. diameter by 12 in. long. In the works our attention was drawn to a recently-installed B.S.A. Acme-Gridley 6-spindle, 6-in. capacity, automatic, and to an automatic lathe tooled up for deep-hole drilling. A new machine shop is in course of erection at these works.

C. LINDLEY & CO., LTD., Luddendenfoot (head office—34, Englefield Road, London, N.1) report a steady demand for bolts, screws, studs, nuts and other repetition cold-formed products, from the motor car, motor vehicle, tractor, aircraft, electrical engineering, oil refining, general engineering, and machine tool industries. Two Birlec furnaces have recently been installed for the heat-treatment of bolts.

SWIFT-SUMMERSKILL, LTD., Sowerby Bridge, are well placed for planing machine orders, which cover double-housing machines ranging from 3 to 7 ft. wide, with strokes up to 30 ft., and openside types of 30- and 48-in. width capacity. Export business is in hand for Canada, India, South Africa and Australia. One of the firm's 30-ft. stroke, 54-in. wide by 48-in. high spiral-electric planing machines has recently been added to the plant.

HENRY BROADBENT, LTD., Sowerby Bridge, in addition to their standard 8½- to 10½-in. centre lathes, are building a 12½-in. centre lathe on 14-ft. long bed, for Canada, also a 28-in. centre lathe on a 31-ft. long bed. A 27-in. centre lathe on a 24-ft. long bed was recently supplied to Steel, Peech & Tozer, Ltd., Sheffield, and a 24-in. centre lathe on a 24-ft. long bed to Canada. A double-headed boring machine for electric motor bodies is on order for the British Thomson-Houston Co., Ltd., Rugby. A good demand is being experienced for vertical boring and turning mills of 5-, 6-, 8- and 10-ft. diameter capacities, and we may note the recent issue of a new brochure describing these machines. Recent additions to plant include a Union 5½-in. spindle floor-type boring machine and a Herbert No. 7B capstan lathe, and at the firm's Mytholmroyd works, additional Broadbent centre and surfacing and boring lathes have been added.

RUSHWORTH & CO. (SOWERBY BRIDGE), LTD., Sowerby Bridge, have a wide range and variety of plate-working equipment on order for both home and overseas customers, including single- and double-ended punching and shearing machines, plate bending rolls, guillotine shearing machines, beam bending machines, and scrap shearing machines.

JAMES BEDFORD & CO. (HALIFAX), LTD., Sowerby Bridge, have recently noted some expansion in the demand for steel factory equipment, comprising tool cabinets, workshop benches, adjustable shelving, stacking trays, and storage bins. The ranges of tool cabinets and workshop benches have recently been extended. There is an increasing demand for the firm's new mobile inspection unit, which was described in MACHINERY, 92/1412—13/6/58. The metal spraying capacity at these works has recently been doubled.

SIMILEX MANUFACTURING CO., LTD., Sowerby Bridge, are doing a good business in all-steel welded swarf and flat-topped trucks, and in two sizes of metal sack trucks. Other active lines include Slik standard and special T-bolts and T-nuts, forged steel clamps and square-hole spanners for toolpost screws, light boxes, and steel bar storage racks.

H. B.

The Midlands

CLARKSON (ENGINEERS), LTD., King Edward Road, Nuneaton, Warwickshire, continue to receive substantial orders for their extensive range of milling cutters, reamers and chucks, which are selling well in this country and overseas. The company has eight regional branches and stockrooms in the U.K., the newest being at Leeds. A stockroom has been provided also at Detroit, U.S.A., and in Europe there are Clarkson subsidiary companies in Brussels, Dusseldorf, Amsterdam and Milan. Tool sales in Canada are handled by the branch at Toronto. The works in Nuneaton have been extended several times since the end of the late

war, and at present have an area of 75,000 sq. ft. The facilities provided here enable production to be maintained at a high level. New tools are introduced at intervals to meet the needs of industry and it may be noted that the Clarkson reamer with a right-hand spiral, first marketed two years ago, and now made with a 30-deg. spiral angle, is selling at an increased rate. The heavy-duty Autolock and Dedlock chucks for milling cutters are used extensively in heavy industries, particularly shipbuilding. The turnover last year was the highest in the group's history.

CLEVELAND TWIST DRILL (GREAT BRITAIN), LTD., Peterhead, Scotland, and Stratford Road, Shirley, Solihull, Warwickshire, are steadily increasing the output of Cle-Forge twist drills and Mo-Max ground tool bits at their new works at Peterhead, where production started last year. Special machine tools shipped from the factory of the parent company in Cleveland, U.S.A., or acquired in the United Kingdom and Europe, are installed in the new works which, it is claimed, are of an exceptionally high standard in all respects.

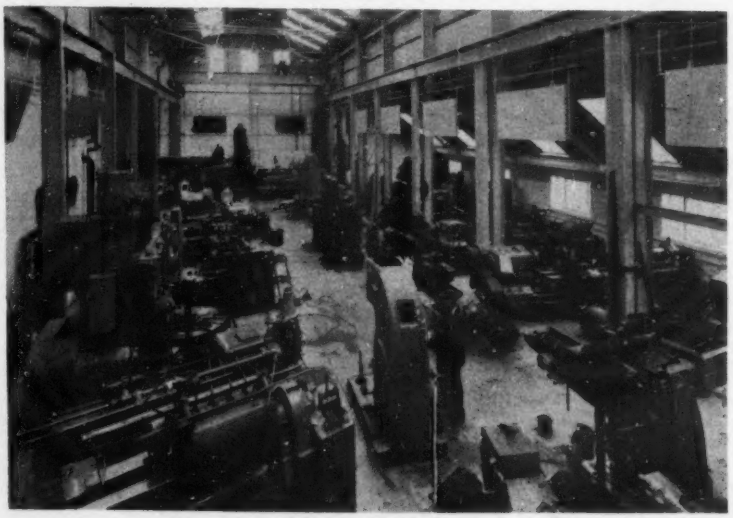
Although the Peterhead factory was completed rather less than a year ago, it is announced that it is already to be extended in accordance with the company's programme of expansion. The extension, which will amount to 35,000 sq. ft., will provide both manufacturing and office space, and will bring the total floor area to more than 100,000 sq. ft. Construction will be carried out by Scottish Industrial Estates, Ltd., who also built the original factory, and it is hoped that the new facilities will be in use within 12 months.

Output at present is confined mainly to straight shank drills and tool bits, but these items will be supplemented shortly by taper shank drills and special-purpose drills. All the tools are made from a steel with a high molybdenum content. This high-speed steel is stated to be well suited for twist drills, and in support of this claim the manufacturers have drawn our attention to results of tests which have been conducted recently in different engineering works. When drilling a nickel-chrome-cobalt alloy, for example, the tool life between regrinds for Cle-Forge 0·040-in. diameter drills was five times that obtained with the drills originally used. Extended life has also been reported for drills which are used to produce holes through 2¼-in. thick stainless steel cylinder walls. In addition, good reports have been received concerning the performance and life of drills used on malleable iron, brass, and steel components.

Mo-Max cobalt high speed steel ground toolbits have been used with success for machining Nimonic alloys, Tufnol, ebonite, polythene, and other materials. When these tools were employed for repetition work on automatics producing components from S.97 material, unusually long life is said to have been obtained.

The sales and service organization of this company is being expanded to cover firstly the British Isles, and eventually the rest of the world with the exception of the U.S.A. and Mexico. Distributors have already been appointed in the main centres of industry in this country.

WILLIAM WATTS, LTD., Canal Street, Nottingham, who have been established for 89 years as dealers in machine tools, iron and steel, and small tools, have now completed the modernization of their premises, including the machine shop. A new building has been erected for the iron and steel section where large quantities of steel are held in stock.



A View in the New Reconditioning Shop at the Works of William Watts, Ltd.

The new shop, as can be seen from the illustration, on page 1480, has been specially designed to accommodate large machine tools, and loads up to 20 tons can be lifted by the overhead electric travelling crane. Special attention has been paid to lighting to ensure good facilities for rebuilding and inspection, and heating is thermostatically controlled.

This firm hold the sole agencies in the United Kingdom for Union horizontal boring machines and Niles vertical borers. A variety of new British and Continental machines is held in stock, together with a wide selection of rebuilt and used machine tools.

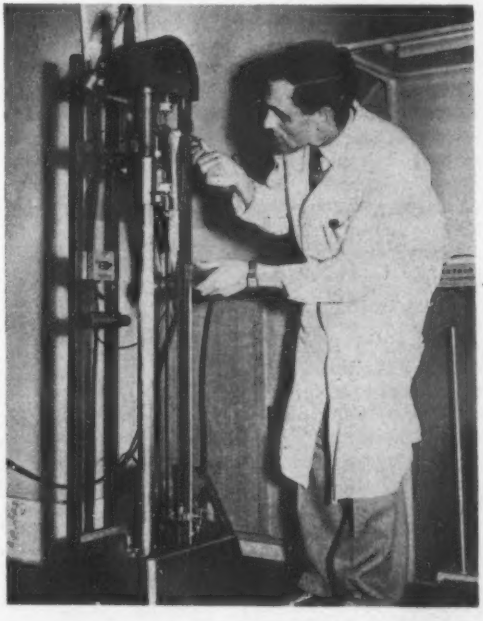
C. H. ELSON (ENGINEERS), 4, Percy Street, Coventry, have various jigs and fixtures in progress. This firm also undertakes development work and the construction of special-purpose equipment. During recent years, fixtures have been produced for the textile industry, and several interesting appliances have been developed as a result of the experience gained in this field. A small machine, which is the subject of a patent application, was recently constructed for lapping the radiused entries of small dies and guides for synthetic threads and other materials. The lapping operation, which was formerly carried out laboriously by hand, can now be accomplished quickly and automatically by means of a simple mechanism. This firm also specializes in drilling holes of small diameter, and several interesting set-ups have been devised to facilitate such work.

F. W. H.

Yarsley Research & Testing Laboratories

Recently, the titles of Dr. V. E. Yarsley (Research Laboratories, Ltd., and Dr. V. E. Yarsley (Plastics Testing Laboratories), Ltd., were altered to Yarsley Research Laboratories, Ltd., and Yarsley Testing Laboratories, Ltd. Situated at Oaklands, Clayton Road, Chessington, Surrey, both laboratories provide facilities for sponsored research, or contract research as it is sometimes termed, in many fields. Most of the work undertaken, however, is concerned with the development, testing, and utilization of plastics, synthetic fibres, rubbers, paints, adhesives, and related materials. The laboratories are the outcome of the consulting practice which was established in 1931 by Dr. Yarsley to deal with problems associated with cellulose plastics. Later, the scope of the practice was enlarged to include work on many additional plastics. For many years these laboratories have provided a service for developing manufacturing processes to the stage at which product design or quality enables full scale production to be started.

Since 1951, when Dr. Yarsley's practice was formed into a limited company, the demand for the services of the organization has steadily grown, with the result that the staff now employed numbers more than 100. The research laboratories are divided into four main sections, which have co-ordinated activities. Group (1) conducts research into moulding and fabrication of thermoplastics materials and problems associated with epoxide resins. Design and construction of specialized plant, machinery, and equipment for laboratory, pilot plant, or full scale production, is the responsibility of Group (2), and the facilities of this department are utilized for the development of prototype machines for handling plastics and other materials, according to the needs of the sponsors. Such a machine, now in its final stages of development in the laboratory workshop, is intended for the continuous production of composite metal and plastics strip. The metallic portion of the strip is punched from copper foil and deposited, in a regular pattern, on the surface of a continuously moving film of plastics material. A similar plastics layer is then applied to the



Testing a Sample of Rubber in One of the Departments of Yarsley Testing Laboratories at Chessington

patterned surface thus produced, in order to seal the metal within a protective envelope.

Among other new products at present undergoing tests in the laboratory workshop, is a polishwheel made from a plastics base to which is added a proportion of a special abrasive. The mixture is moulded under heat and pressure, and formed into circular blanks, which may then be mounted on polishing spindles in the normal manner. Tests carried out with such polishing wheels containing abrasive of different grain sizes, show that surface finishes of 8 to 10 micro-inches can be obtained on previously turned work. The finished surfaces produced in this manner, it has been demonstrated, are temporarily protected from the effects of atmospheric corrosion by virtue of the thin film of plastics deposited during the polishing process. The wheels may be used wet or dry for many polishing applications, and it is stated that good results have also been obtained when the material has been employed for honing operations. Technological and chemical research relating to polymerization and the application of high energy radiation in the chemical industry is carried out by Group 3, while problems associated with thermosetting resins, expanded plastics, particle board, and similar products are investigated by Group 4.

The testing laboratories are well equipped to carry out comprehensive programmes of investigation which may include, for example, control sampling and tests extending over periods of several years. These facilities are used by manufacturers who may lack adequate testing equipment and trained laboratory staff. At the same time, companies with large research organizations often submit samples for independent testing. In the illustration, on p. 1481, a rubber specimen is being subjected to a tensile test on a Hounsfield rubber testing machine. In addition to standard testing machines, there is much equipment of specialized design which has been calibrated to N.P.L. standards. Apparatus is installed in the mechanical testing department, for instance, for 33 different tests, and certain tests may be conducted under varying ambient conditions.

It may be noted that the laboratories are officially recognized by the A.I.D. and A.R.B. for the testing of rubbers and plastics.

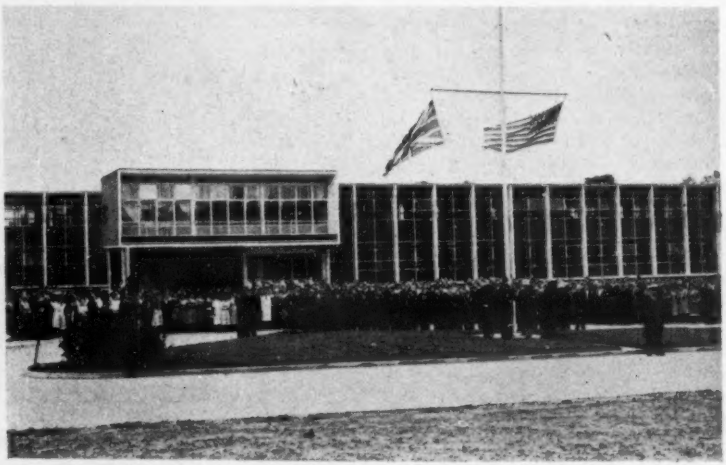
Some of the projects undertaken extend into the sponsors' factories, and under such an arrangement the staff associated with a particular investigation initially may carry the work forward to the final production stage.

New Foxboro-Yoxall Factory

The new factory and office block built for Foxboro-Yoxall, Ltd., at Redhill, Surrey, were recently officially opened, and a view of the opening ceremony, with the 2-storey office block in the background, is shown in the accompanying figure. The factory, which occupies an area of 85,000 sq. ft., is situated immediately behind the office block, and is connected to it by covered ways. The factory is of single-storey design, and in order to keep the walls free from cables and conduits, all the service mains are housed in an underground tunnel, which extends the full length of the building and enters the power house.

Production lines in the factory are arranged in a circular formation, so that goods enter and leave the building at approximately the same point, and the central area of the building is utilized for storage purposes.

Particular attention has been paid to the lighting, heating and ventilation services, in order to provide the type of working conditions which are required for the production of high-quality precision instruments. The north-lighted roof ensures



Opening of the New Foxboro-Yoxall Factory at Redhill, Surrey

the maximum of natural light, and artificial illumination is provided by fluorescent tube units. The power house, which occupies an area of 5,000 sq. ft., has been designed with a view to future expansion, and is large enough to accommodate equipment to serve a factory of three times the present size.

The other buildings on the site include a restaurant with three separate dining rooms, at which between 600 and 700 meals per day are served, and the adjacent area to the north of the factory is being laid-out as a sports field.

Balancing Railway Wheel Sets

A meeting was held recently at the showrooms of Sidney G. Jones, Ltd., 8 Balham Hill, London, S.W.12, to discuss a new method of dynamically balancing railway wheel sets which has been proposed by the German firm of Hofmann, for whom Sidney G. Jones, Ltd., are the sole selling agents in the United Kingdom. The meeting, which was attended by senior engineers from the various regions of British Railways, was addressed by Herr R. Hofmann, who described the new method and exhibited drawings of the proposed machine.

Railway wheel sets are at present dynamically balanced in the conventional manner by machines which support and locate the assembly by its journal bearings, but it was suggested that this method was inherently incorrect since, when the set is in service, it is not located by the journal bearings, which are allowed to float in the suspension system, but by the rim, which is in contact with the track. The proposed machine, therefore, has been so designed that the set would be supported on two pairs of widely-spaced free-running rollers, in contact with the rims of the tyres, the intention being to simulate as nearly as possible the actual working conditions. Between each pair of rollers, and immediately below the centre of the axle, there would be a power-driven contact roller, which would engage the tyre and serve to rotate the set during the balancing operation.

Each pair of support rollers would be carried in a heavy-section bridge member, suspended at each end by a single, vertical leaf spring. With this arrangement, the bridges would be allowed a limited amount of horizontal movement in response to the out-of-balance forces which were generated during balancing. These movements would be sensed electronically and fed to a dial-type instrument from which the amount of unbalance could be read directly.

Another pick-up would be driven directly from the axle of the set, by means of a shaft and universal joints, and would serve to indicate the angular position of the unbalance on a further dial-type instrument.

The main advantage claimed for a balancing machine of this design is that the amount and position of the point of maximum unbalance could be determined more accurately, since the wheel set would be rotated in strict relation to the actual working datum—i.e. the periphery of the tyre. Furthermore, this method of mounting the set would enable a wide range of wheel sizes to be accommodated, as, within reason, the centre height of the set would be of no importance, and no account would have to be taken of the diameter of the journal bearings.

Correction

In the advertisement for Newman Industries, Ltd.' which appears on page 137 of this issue of MACHINERY, the telephone number of the Birmingham Branch is given wrongly. The correct number is Northern (Birmingham) 9634.

The Price of a Subscription to MACHINERY is 52 Shillings per annum, post free, to any part of the world.

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20/6/58

Industrial Notes

THE BRITISH ASSOCIATION OF MACHINE TOOL MERCHANTS (INC.) will move, on June 24, to larger office premises at Effingham House, Arundel Street, Strand, London, W.C.2 (telephone number Temple Bar 6101/4).

ABWOOD/ENOTS PNEUMATIC VICE.—We are asked to state that this vice, which was described in MACHINERY, 92/1350—6/6/58, is obtainable from Abwood Machine Tools, Ltd., Princes Road, Dartford, Kent, as well as from Benton & Stone, Ltd., Aston Brook Street, Birmingham, 6.

PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2, inform us that their offices and showrooms for the North-east region are now at 72 Wellington Street, Leeds 1. The trade counter and stores occupy the adjacent premises at 2 Britannia Street, Leeds 1.

GIBBONS BROS., LTD., Dudley, have recently received orders, totalling £3,750,000, from the South Durham Steel & Iron Co., Ltd., Middlesbrough, for a range of large furnaces, steel-making plant, coke and coal handling plant, and three batteries of 78 ovens, to be installed at Hartlepool. The work is to be completed by 1961.

BRITISH INSULATED CALLENDER'S CABLES, LTD., 21 Bloomsbury Street, London, W.C.1, have opened a new store and sales office at 67/77 Holloway Head, Birmingham 1. The store has a floor area of 11,000 sq. ft., and will allow the company to double the amount of stock which was formerly held in the Birmingham district.

EMPLOYMENT IN THE MANUFACTURING INDUSTRIES.—According to the *Ministry of Labour Gazette* the number of people employed in manufacturing industry fell by 40,000 during March, to 9,214,000. There was a decrease of 15,000 in "engineering, metal goods and precision instruments," of 1,000 in "vehicles," and of 4,000 in "metal manufacture."

MORTIMER ENGINEERING CO., 204/206 Acton Lane, Harlesden, London, N.W.10, have been appointed the distributors and stockists for the United Kingdom of the Bammesberger range of special-purpose machines and drilling heads. The range includes unit-built machines, with universal-joint shaft assemblies, indexing drums and sliding and circular indexing tables.

BRITISH CENTRAL ELECTRICITY CO., LTD., 6/8 Rosebery Avenue, London, E.C.1, have developed a flowmeter for use with their range of portable electric barrel pumps. The meter measures the quantity of liquid being pumped, and is available in two sizes, with dials of 5½ in. and 5 in. diameter. The dial is calibrated from 0 to 25 gal., and a 4-figure register is incorporated, which shows the total number of gallons pumped at any given time.

TURNER BROTHERS (BIRMINGHAM), LTD., Cliveland Street, Birmingham, 19, recently opened a new factory at the Blantyre Industrial Estate, near Hamilton, Lanark, Scotland. Small scale production of jigs, fixtures and press tools has already started in these premises, which occupy at present a floor area of 5,000 sq. ft., extra space being available for subsequent expansion. A display of Jones & Shipman machine tools was staged in connection with the opening.

ASSOCIATION OF ENGINEERING DISTRIBUTORS, LTD., Hastings House, Norfolk Street, London, W.C.2. At the third of the 1958 series of Council Luncheons, Mr. Robert Appleby, managing director of Black & Decker, Ltd., Harmondsworth, Middlesex, was the principal guest, and in his speech he explained his company's recently-introduced "shared discount plan" for the distributive trade. The luncheon was followed by a Council meeting at which the draft annual accounts for the year ended April 30, 1958, were approved by the Executive Committee.

ELECTRO-CHEMICAL ENGINEERING CO., LTD., announce that, as from July 1, 1958, supplies and service for the Efco-Udylite processes will no longer be available from R. Cruickshank, Ltd., Camden Street, Birmingham, 1. From that date, these facilities will be provided direct from Electro-Chemical Engineering Co., Ltd., Sheerwater, Woking, Surrey, and from the depots at Booth Street, Handsworth, Birmingham, 21, and Chaddock Industrial Estate, Astley, near Manchester. The Hockley Chemical Co., Ltd., Hockley Hill, Birmingham, 18, will also act as selling agents, and provide a technical service, in England and Wales, and the company's products will be handled in Scotland by H. A. Dawson-Bowman, Brisbane House, Rowan Road, Glasgow, S.1.

IBM UNITED KINGDOM, LTD., 101 Wigmore Street, London, W.1, inform us that they have developed a magnetic core calculating unit, known as the type 628, which is intended for applications which fall between the capacities of the existing types IBM 604 and 650. This new unit is designed to work in conjunction with the IBM type 565 card punch and the type 421 high-speed accounting machine, and it then has an input of 150 cards per min., and can print 150 lines per min. The type 628 calculator has a storage capacity of 320 digits and can handle a programme consisting of 160 different steps, which can be selected in any required sequence. It can add and subtract in 180 microseconds, and can perform a multiplication with a 16-digit product at an average speed of 8 milliseconds.

THE APPLEBY-FRODINGHAM STEEL CO., Scunthorpe, Lincs., a branch of the United Steel Companies, Ltd., 17 Westbourne Road, Sheffield, have developed a new desulphurising and sulphuric acid plant which is claimed to offer considerable advantages over existing methods. This new process, it is stated, enables the hydrogen sulphide and organic sulphur content of coke oven and town's gas to be reduced to a very low level, and permits the recovery of considerable quantities of sulphuric acid.

The first full-scale plant, which will handle 32 million cu. ft. of gas per day and can be operated by only two men per shift, is now being installed at the Appleby-Frodingham works by W. J. Fraser & Co., Ltd., Romford, Essex, who, in conjunction with Henry Balfour & Co., Ltd., Leven, Fife, have been appointed licensees for the construction of plant based on this process.

The Coil Spring Federation

At the annual conference of the Coil Spring Federation, which was held recently at Torquay, the president, Mr. R. Salter Bache, stressed the need for the recruitment of more members to support the spring industry's research organization. Because of competition, Mr. Bache stated, there was an increasing need for collaboration within the industry, especially with regard to research, if new materials, processes, and techniques for spring production were to be developed.

It was reported that the research organization of the Federation, which is located at Hoyle Street, Sheffield, 3, has been granted financial assistance by the Department of Scientific and Industrial Research for a further five years, and that, in accordance with the undertakings given to this body, new laboratories were being erected in Sheffield. Acknowledgment was made to the British Iron and Steel Research Association for the assistance which has been rendered to the Federation with regard to the provision of extra space.

The Federation, which has its offices with Peat, Marwick, Mitchell & Co., Ltd., 301 Glossop Road, Sheffield, 10, has issued a booklet entitled " Spring Research in Industry," which outlines the structure of the research organization, and gives details of the scope of the current programme. Photographs are given of some of the equipment employed, including various types of fatigue-testing machines, surface treatment plant, and materials testing machines.

Birthday Honours

The recently published Birthday Honours List includes the following:

Knights Bachelor

Black, W. R., chairman, National Research and Development Corporation and managing director of the A.C.V. Group.

Jackson, W., director of research and education, Metropolitan-Vickers Electrical Co., Ltd.

C.B.

Girling, J. L., lately Comptroller-General, Patent Office and Industrial Property Department, Board of Trade.

Morgan, M. B., deputy Director, Royal Aircraft Establishment, Farnborough.

C.B.E.

Brown, T. W. F., director, Parsons & Marine Engineering Turbine Research and Development Association.

Cole, E. K., chairman and managing director, E. K. Cole, Ltd., Southend-on-Sea.

Jackson, J. E., director, Royal Ordnance Factories, Ministry of Supply.

Moult, E. S., director and chief engineer, de Havilland Engine Co., Ltd., Edgware.

Sayce, L. A., superintendent, Light Division, National Physical Laboratory, Department of Scientific and Industrial Research.

Wilson, G. H., chairman and managing director, Laurence Scott & Electromotors, Ltd., Norwich.

O.B.E.

Ash, W. T., Secretary, Radio and Electronic Component Manufacturers' Federation.

Crawhall, T. C., assistant director, Mechanical Engineering Research Laboratory, D.S.I.R.

Greengross, Alderman M.P., managing director, Indusmond (Diamond Tools), Ltd., London.

Haworth, L., chief designer, civil engines, Rolls-Royce, Ltd., Derby.

Mann, R. W., chairman, Tyneside Productivity Committee.

Murray, G., production controller, engineering group, Remploy, Ltd.

Rowbotham, P., principal inspector, Inspectorate of Armaments, Ministry of Supply.

Simpson, L. M., chief engineer and manager, Telegraph Division, Automatic Telephone & Electric Co., Ltd., Liverpool.

Tunstall, H. A., assistant research manager, W. T. Henley's Telegraph Works Co., Ltd.

Webster, C. H., chief engineer, Royal Ordnance Factory, Pembrey.

Wright, R. P. M., engineering manager, Harland & Wolff, Ltd., Belfast.

Students Industrial Design Exhibition

An exhibition held at the London County Council Central School of Arts and Crafts, Southampton Row, W.C.1, from June 4 to 11, illustrated the training undertaken, and standards subsequently attained, by students of the 3-year full-time course in industrial design for the light engineering industries. Emphasis was placed on designs for quantity-produced consumer goods, and among the exhibits which had been designed and made by students were a washing machine and a refrigerator, both with fibre-glass interiors in sheet-metal cabinets, a spin drier, and a variety of kitchen hardware in stainless steel.

During the first year of the course, instruction is given in subjects such as drawing office procedure, metal-working and woodworking practice, applied logic and scientific method, plaster casting, and design theory. For the second year, students receive teaching in production technology, product design, advanced drawing office practice, plastics technology, model making, and photography, and, subsequently, are found employment in factories during their summer vacation. The syllabus for the third year includes the solution of specific design problems to prescribed degrees of completion, and students who achieve the required standards are awarded the Diploma of the Central School of Arts and Crafts.

Obituary

MR. H. F. BARRUS, joint managing director of E. P. Barrus (Concessionnaires), Ltd., 12-16 Brunel Road, Acton, London, W.3, died suddenly on June 4. Born in Athol, Mass., U.S.A., he began his business career with the Union Twist Drill Co., and became sales manager. In 1922 he came to London to join his uncle, Mr. E. P. Barrus in representing, in Europe, a number of American companies, and held the position of sales manager before being appointed joint managing director. During the war, Mr. Barrus served on the Small Tool and Hand Tool Advisory Panels of the Ministry of Supply.

BRITISH MACHINE TOOL

Exports of New Machine Tools

Countries	Vertical Boring Machines		Other Boring Machines		Drilling Machines		Grinding, Lapping and Honing Machines		Automatic Lathes		Capstan and Turret Lathes		Other Lathes		Screwing Machines	
	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £
Commonwealth																
South Africa	—	—	14 (2)	602	526 (83)	14,126	341 (55)	16,130	319 (4)	12,915	180 (3)	6,195	926 (95)	30,288	4 (8)	187
India	8 (3)	325	321 (19)	15,292	918 (22)	17,799	897 (34)	25,753	292 (5)	19,899	1,292 (23)	54,728	939 (23)	25,700	320 (4)	20,577
Pakistan	—	—	2 (1)	190	4 (2)	127	—	—	—	—	—	—	— (1)	117	—	—
Australia	—	—	222 (2)	5,481	666 (25)	15,876	176 (7)	6,014	301 (4)	11,648	991 (18)	30,839	567 (28)	15,642	37 (2)	1,090
New Zealand	—	—	—	—	326 (51)	7,675	40 (30)	1,081	—	—	124 (1)	4,453	454 (19)	12,257	— (1)	125
Canada	—	—	—	—	252 (8)	4,371	149 (109)	9,933	616 (5)	30,369	169 (3)	6,057	961 (27)	29,174	73 (2)	2,765
Miscellaneous	215 (1)	5,476	6 (4)	841	443 (56)	10,817	297 (101)	11,206	—	—	67 (1)	3,036	695 (46)	20,622	—	—
Foreign																
Soviet Union	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sweden	—	—	—	—	771 (6)	16,154	28 (3)	3,920	152 (2)	6,432	453 (9)	15,168	14 (2)	520	—	—
Norway	—	—	— (1)	87	—	—	40 (5)	2,082	—	—	—	—	33 (10)	1,374	—	—
Denmark	271 (1)	4,935	—	—	4 (2)	148	11 (1)	513	—	—	—	—	—	—	—	—
Western Germany	—	—	—	—	—	—	7 (6)	1,867	20 (2)	3,770	—	—	12 (1)	404	—	—
Netherlands	—	—	476 (1)	22,075	143 (17)	3,781	289 (16)	8,828	—	—	111 (3)	4,373	26 (2)	1,205	—	—
Belgium	—	—	—	—	90 (4)	1,698	—	—	37 (1)	2,024	166 (2)	4,853	54 (6)	2,826	—	—
France	—	—	164 (3)	4,410	20 (1)	208	1,112 (22)	44,552	34 (1)	1,854	86 (1)	4,644	171 (1)	1,601	—	—
Switzerland	147 (2)	2,812	—	—	57 (3)	2,169	24 (3)	2,989	—	—	138 (5)	9,038	—	—	—	—
Spain	—	—	—	—	623 (10)	24,083	175 (3)	8,266	562 (6)	31,457	78 (2)	3,426	133 (1)	6,423	—	—
Italy	—	—	—	—	29 (1)	2,219	59 (5)	3,497	—	—	165 (1)	6,002	30 (11)	1,492	—	—
U.S. America	435 (2)	10,328	21 (1)	1,230	327 (7)	7,917	177 (11)	9,438	49 (1)	1,096	492 (7)	13,258	761 (38)	23,829	—	—
Miscellaneous	—	—	24 (8)	1,277	766 (48)	20,534	343 (49)	26,478	139 (1)	5,646	399 (8)	19,076	749 (75)	24,840	20 (2)	967
Total	1,076 (9)	23,876	1,250 (42)	51,485	5,965 (346)	149,702	4,165 (460)	182,547	2,521 (32)	127,110	4,911 (87)	185,146	6,525 (386)	198,314	454 (19)	25,711
Amendments to previous accounts																
Commonwealth	—	—	—	—	—	—	+434 (+4)	+13711	—	—	—	—	+159 (+1)	+3,525	—	—
Foreign	—	—	+7 (+2)	+294	−7 (−5)	−459	+100 (+2)	+7,598	—	—	—	—	— (+33)	—	—	—

Total exports of reconditioned machine tools: Quantity: No., 81; Weight, 4,292 cwt.; Value, £55,274.
Total exports of imported machine tools: Quantity: No., 15; Weight, 1,371 cwt.; Value, £41,821.

Imports of New Machine Tools

Country of Origin	Boring and Broaching Machines		Drilling Machines		Gear-cutting Machines		Grinding, Lapping and Honing Machines		Automatic Lathes	
	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £
Western Germany	1,257 (7)	49,929	288 (16)	14,736	96 (2)	5,657	990 (34)	53,975	2,302 (34)	106,053
Belgium	—	—	—	—	—	—	—	—	—	—
France	—	—	(1)	20	—	—	5 (2)	545	168 (3)	9,383
Switzerland	368 (7)	31,003	31 (6)	2,755	36 (3)	4,204	369 (21)	34,330	861 (34)	64,967
U.S. America	—	—	—	—	551 (2)	43,467	159 (3)	23,418	461 (9)	30,736
Miscellaneous	648 (8)	22,806	493 (20)	9,099	—	—	1,048 (15)	47,950	98 (4)	3,728
Total	2,273 (22)	103,738	812 (43)	26,610	683 (7)	53,328	2,571 (75)	160,218	3,890 (84)	214,867
Amendments to previous accounts										
Western Germany	+678 (+3)	+13,855	—	—	—	—	—	—	—	—
France	—	—	—	—	—	—	—	—	—	—
Miscellaneous	—	—	—	—	—	—	—	—	—	—

Total imports of reconditioned machine tools: Quantity: No., 25; Weight, 361 cwt.; Value, £21,620.

IMPORTS AND EXPORTS (Classified)

and Parts during February, 1958

Threading Machines		Milling Machines		Gear-cutting Machines		Planing, Shaping and Slotting Machines		Presses		Sheet Metal-working Machines		Sawing Machines		Other Machines		Machine-tool Parts*		Total	
Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt.	Value £	Quantity. Cwt. and No.	Value £
—	—	144 (7)	5,819	—	—	736 (9)	15,459	593 (13)	13,604	28 (2)	446	59 (7)	1,044	573 (21)	17,828	232	14,294	4,675 (309)	148,937
94 (3)	7,791	151 (4)	8,090	—	—	149 (5)	3,453	501 (11)	13,220	54 (2)	1,709	24 (2)	1,200	1,204 (22)	34,772	203	10,902	7,367 (182)	261,210
—	—	5 (1)	270	—	—	—	—	111 (19)	2,958	—	—	—	—	184 (4)	4,966	6	586	312 (28)	9,214
138 (4)	9,710	669 (8)	33,534	—	—	240 (9)	4,674	1,850 (14)	27,406	—	—	188 (6)	4,423	423 (14)	13,505	280	16,718	6,748 (141)	196,560
13 (1)	379	—	—	—	—	53 (3)	715	1 (2)	56	—	—	69 (14)	1,939	493 (11)	16,048	67	2,127	1,640 (133)	46,855
—	—	178 (4)	7,856	—	—	214 (7)	5,063	438 (11)	10,532	390 (2)	8,625	22 (1)	316	164 (4)	2,383	758	23,190	4,384 (183)	140,634
36 (2)	1,337	397 (8)	20,783	—	—	559 (13)	12,426	1,670 (23)	34,983	61 (6)	762	59 (12)	1,474	88 (24)	2,371	603	15,501	5,196 (297)	141,635
—	—	—	—	—	—	—	—	—	—	2,100 (3)	28,272	—	—	—	—	—	—	2,100 (3)	28,272
—	—	—	—	—	—	—	—	—	—	—	—	81 (1)	1,459	—	—	34	2,202	1,533 (23)	45,855
—	—	—	—	—	—	—	—	12 (1)	207	—	—	—	—	—	—	67	10,491	152 (17)	14,241
—	—	—	—	—	—	122 (1)	3,780	—	—	—	—	—	—	1 (1)	56	7	1,001	416 (6)	10,432
—	—	—	—	—	—	—	—	47 (1)	1,725	489 (1)	14,000	—	—	116 (1)	4,897	79	2,661	770 (12)	29,324
—	—	74 (2)	3,468	—	—	32 (2)	604	84 (4)	2,950	—	—	—	—	38 (1)	1,667	27	2,999	1,300 (48)	51,950
—	—	540 (3)	22,807	—	—	—	—	—	—	—	—	—	—	3 (2)	475	23	1,813	913 (18)	36,496
—	—	—	—	272 (5)	16,332	44 (1)	2,083	93 (1)	5,936	—	—	74 (1)	1,527	738 (9)	33,286	69	6,638	2,877 (46)	123,071
—	—	—	—	—	—	—	—	—	—	—	—	—	—	83 (1)	3,807	16	1,820	465 (14)	22,635
—	—	—	—	—	—	—	—	2,605 (2)	62,751	—	—	—	—	205 (1)	7,074	103	3,748	4,484 (25)	147,228
—	—	—	—	3,364 (2)	99,378	—	—	—	—	—	—	—	—	106 (2)	7,153	227	4,701	3,980 (22)	124,442
—	—	35 (1)	714	—	—	22 (2)	429	303 (12)	12,504	41 (1)	2,169	—	—	24 (4)	1,625	294	13,284	2,981 (87)	97,821
200 (5)	19,392	138 (5)	7,451	35 (1)	7,240	242 (16)	4,943	1,279 (18)	28,282	82 (6)	1,489	130 (14)	3,269	1,514 (131)	38,320	215	14,903	6,275 (387)	224,107
481 (15)	38,609	2,331 (43)	110,792	3,671 (8)	122,950	2,413 (68)	53,629	9,587 (132)	217,114	3,245 (23)	57,472	706 (58)	16,651	5,957 (253)	190,233	3,310	149,579	58,568 (1,981)	1,900,920
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+3	+237	—	—
—	—	—	—	—	—	—	—	(−2) — (−6)	—	—	—	—	—	—	—	−100	−7,598	—	—

Figures in parentheses denote number of machines. * Not including machine-tool cutting parts.

and Parts during February, 1958

Other Lathes		Milling Machines		Planing, Shaping and Slotting Machines		Presses and Sheet Metal-working Machines		Other Machines		Machine-tool Parts*		Total	
Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt.	Value £	Quantity. Cwt. and No.	Value £
1,484 (36)	52,283	412 (13)	26,857	130 (7)	5,335	875 (14)	27,376	2,645 (127)	109,730	1,091	97,687	11,570 (290)	549,618
—	—	—	—	—	—	50 (4)	1,944	38 (5)	1,354	30	2,315	118 (9)	5,613
2 (1)	100	506 (12)	29,805	—	—	22 (2)	700	—	—	43	7,711	746 (21)	48,264
8 (1)	589	229 (9)	18,805	—	—	436 (6)	24,620	441 (8)	39,503	226	32,898	3,005 (95)	253,674
—	—	512 (5)	29,381	300 (2)	15,613	4 (1)	222	418 (14)	42,234	1,129	130,791	3,534 (36)	315,862
131 (5)	2,403	495 (18)	22,895	28 (1)	603	655 (4)	19,853	1,104 (17)	30,878	131	13,326	4,831 (92)	173,541
1,625 (43)	55,375	2,154 (57)	127,743	458 (10)	21,551	2,042 (31)	74,715	4,646 (171)	223,699	2,650	284,728	23,804 (543)	1,346,572
—	—	—	—	—	—	—	—	−678 (−3)	−13,855	+450	+14,787	—	—
—	—	—	—	—	—	—	—	—	—	+2	+170	—	—
—	—	—	—	—	—	—	—	—	−115	—	—	—	—

Figures in parentheses denote number of machines. * Not including machine-tool cutting parts.

Zinc Development Association

In a report covering the activities of the Z.D.A. during 1957, it is announced that the group, which includes the Zinc Alloy Die Casters Association, and other affiliated bodies, now has 250 member firms, in the United Kingdom, the Commonwealth, and the U.S.A. There was a considerable interchange of information between the various firms during the past year, and it is reported that increasing use is being made of the information service provided by the Association. This service includes a library and a comprehensive selection of photographs and films, which are available to member firms. During the year, lectures and film shows on the various uses of zinc were given at factories, technical colleges, schools, and professional institutions in various parts of the country.

The Z.A.D.C.A. maintains close liaison with die casting associations in other countries, and mention is made of the Conference held in Paris in May, 1957. A feature of the Association's work last year was the publication of a glossary of die casting terms in French, German, Italian, Spanish, and English.

The Z.D.A. issued a number of new publications during 1957, thereby bringing the total now available to 70, and a certain amount of the existing literature was revised and re-issued. A complete list of these publications is given in the Association's leaflet entitled "Current Publications."

Machine Tool Share Market

Stock markets maintained a firm tone during the past week, but quiet conditions persisted in most sections, with buying interest selective.

The gilt-edged section remained steady to firm, and, on balance, moderate gains were shown among British Funds and other high-grade fixed interest stocks.

Among the principal sections of the industrial share market a satisfactory undertone prevailed. Although interest remained at a low ebb, and movements among prices generally were small, the trend, in the main, was towards slightly higher levels.

Among machine tool issues, Edgar Allen advanced 3d. to 27s. 3d.; Armstrong Stevens 3d. to 8s. 3d.; Chas. Churchill, 1½d. to 4s. 6d.; and Thos. W. Ward, 7½d. to 75s. On the other hand, British Oxygen lost 1s. 6d. at 33s.; B. Elliott, 3d. at 2s. 9d.; Wadkin, Ltd., 3d. at 18s. 6d.; John Harper, 4½d. at 13s. 3d.; Ambrose Shardlow, 6d. at 37s.; and Stedall & Co., 6d. at 5s. 9d.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	9d.
Armstrong, Stevens & Son, Ltd.	Ord.	5/-	8/3
Allen (Edgar) & Co., Ltd.	Ord.	£1	27/3
" " "	5% Prf.	£1	14/9*
Arnott & Harrison, Ltd.	Ord.	4/-	13/6xd
Asquith Machine Tools Corp., Ltd.	Ord.	5/-	18/1½
" " "	6% Cum. Prf.	£1	18/6xd
Birmingham Small Arms Co., Ltd.	Ord.	£1	28/-xd
" " "	5% Cum. "A" Prf.	£1	15/6
" " "	6% Cum. "B" Prf.	£1	17/6
" " "	4% 1st Mort. Deb.	Stk.	85/-xd
British Oxygen Co., Ltd.	Ord.	£1	33/-
" "	6¼% Cum. Prf.	£1	21/3xd
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	4/7½
Broom & Wade, Ltd.	Ord.	5/-	10/4½
" "	6% Cum. Prf.	£1	17/9
Brown (David) Corporation Ltd.	5½% Cum. Prf.	£1	14/-
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/9xd
Butler Machine Tool Co., Ltd.	Ord.	5/-	5/6
"	5% Cum. Prf.	£1	13/9
C.V.A. Jigs, Moulds & Tools, Ltd.	5½% Red. Cum. Prf.	£1	13/9
Churchill (Charles) & Co., Ltd.	Ord.	2/-	4/6xd
" " "	6% Cum. Prf.	£1	26/3
Churchill Machine Tool Co., Ltd.	Ord.	5/-	17/4½
" " "	6% Cum. Prf.	£1	18/6
Clarkson (Engrs.), Ltd.	Ord.	5/-	12/3
Cohen (George), Son & Co., Ltd.	Ord.	5/-	11/10½
" " " "	4½% Cum. Prf.	£1	14/6
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	13/9
" " " " "	5% Cum. Red. Prf.	£1	16/3
Coventry Machine Tool Works, Ltd.	Ord.	4/-	8/9
Craven Bros. (Manchester), Ltd.	Ord.	5/-	6/7½
Elliott (B.) & Co., Ltd.	Ord.	1/-	2/9
" "	4½% Red. Cum. Prf.	£1	13/9xd
Export Tool & Case Hardening Co., Ltd.	Ord.	2/-	1/3
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	12/-
Greenwood & Batley, Ltd.	Ord.	£1	46/10½
Harper (John) & Co., Ltd.	Ord.	5/-	13/3
" "	4½% Red. Cum Prf.	£1	13/1½
Herbert (Alfred), Ltd.	Ord.	£1	32/6
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	10/3
	"B" Ord.	5/-	9/9
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	21/3
" " "	7% Cum. Prf.	5/-	5/-xd
Kayser, Ellison & Co., Ltd.	Ord.	£1	44/6
" " "	6% Cum. Prf.	£1	18/3
Kendall & Gent, Ltd.	Ord.	5/-	7/9
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	6/3
Kitchen & Wade, Ltd.	Ord.	4/-	10/-
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/4½
Massey, B. & S., Ltd.	Ord.	5/-	7/9
Modern Engineering Machine Tools Ltd.	Ord.	5/-	8/6
Newall Engineering Co., Ltd.	Ord.	2/-	4/6
Newman Industries, Ltd.	Ord.	2/-	2/3
	6% Prf. Ord.	5/-	5/6
Noble & Lund, Ltd.	Ord.	2/-	2/9 Ex rights
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	17/-
" " "	5½% Cum. Prf.	£1	25/3
Pratt (F.) & Co., Ltd.	Ord.	5/-	21/3
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	4/6
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	37/-
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	12/3
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	33/9xd
" " " "	5% Cum. Prf.	£1	15/-xd
Stedall & Co., Ltd.	Ord.	5/-	5/9
Tap & Die Corporation, Ltd.	Ord.	5/-	7/6
" " "	4½% Deb. 1961-1977	Stk.	82/-
Wadkin, Ltd.	Ord.	10/-	18/6
Ward (Thos. W.), Ltd.	Ord.	£1	75/-
" "	5% Cum. 1st Prf.	£1	18/9
" "	5% Cum. 2nd Prf.	£1	25/-
Willson Lathes, Ltd.	Ord.	1/-	2/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. † Birmingham price.